SCIENTIFIC AMERICAN

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MAJOR KING'S GREAT MAGNET.

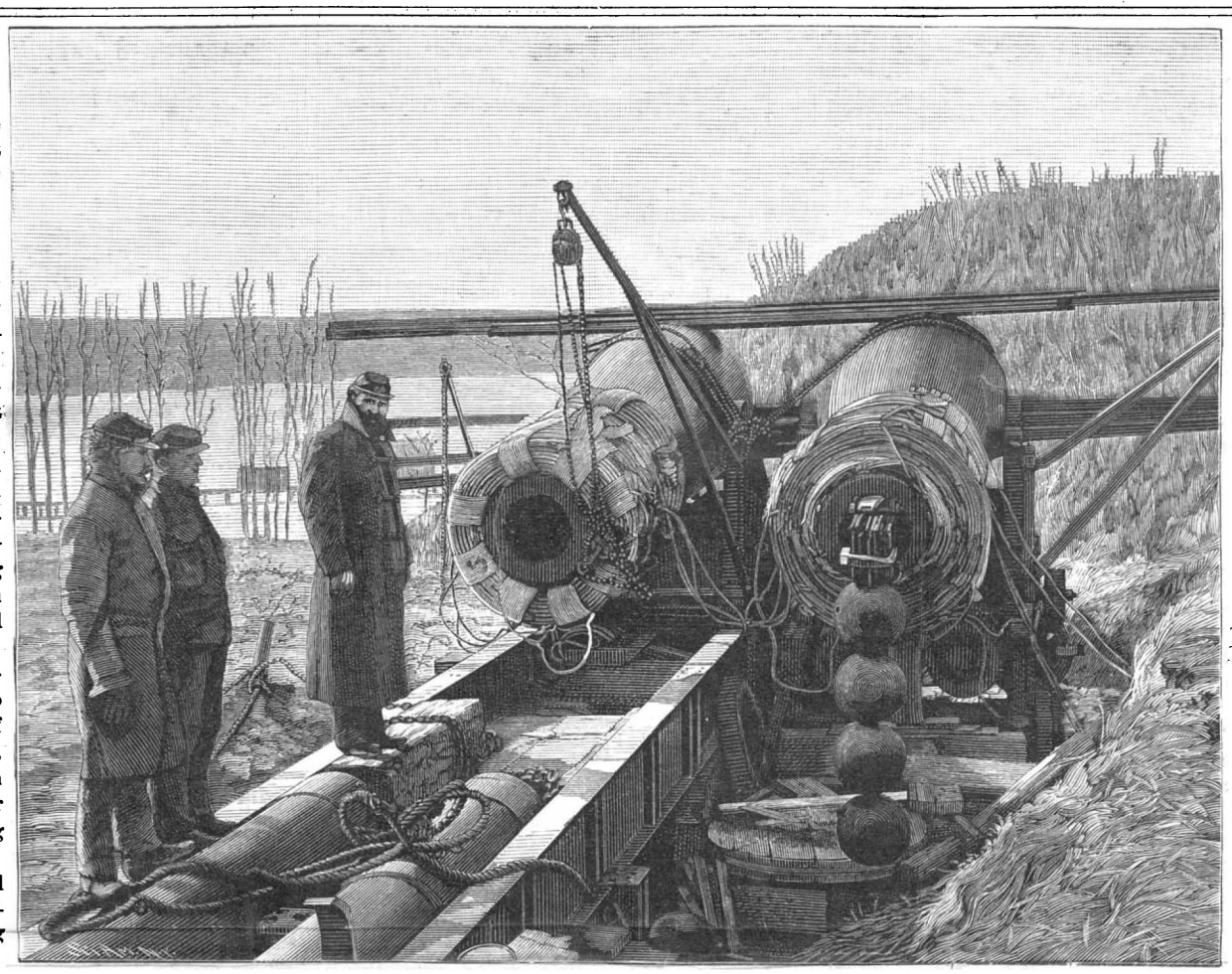
An interesting magnetic experiment on a large scale has lately been made at Willets Point, N. Y., by Major W. R. King, of the Engineer Corps, U. S. A., consisting in the conversion of a pair of great cannons, each weighing over twenty tons, into an electro-magnet.

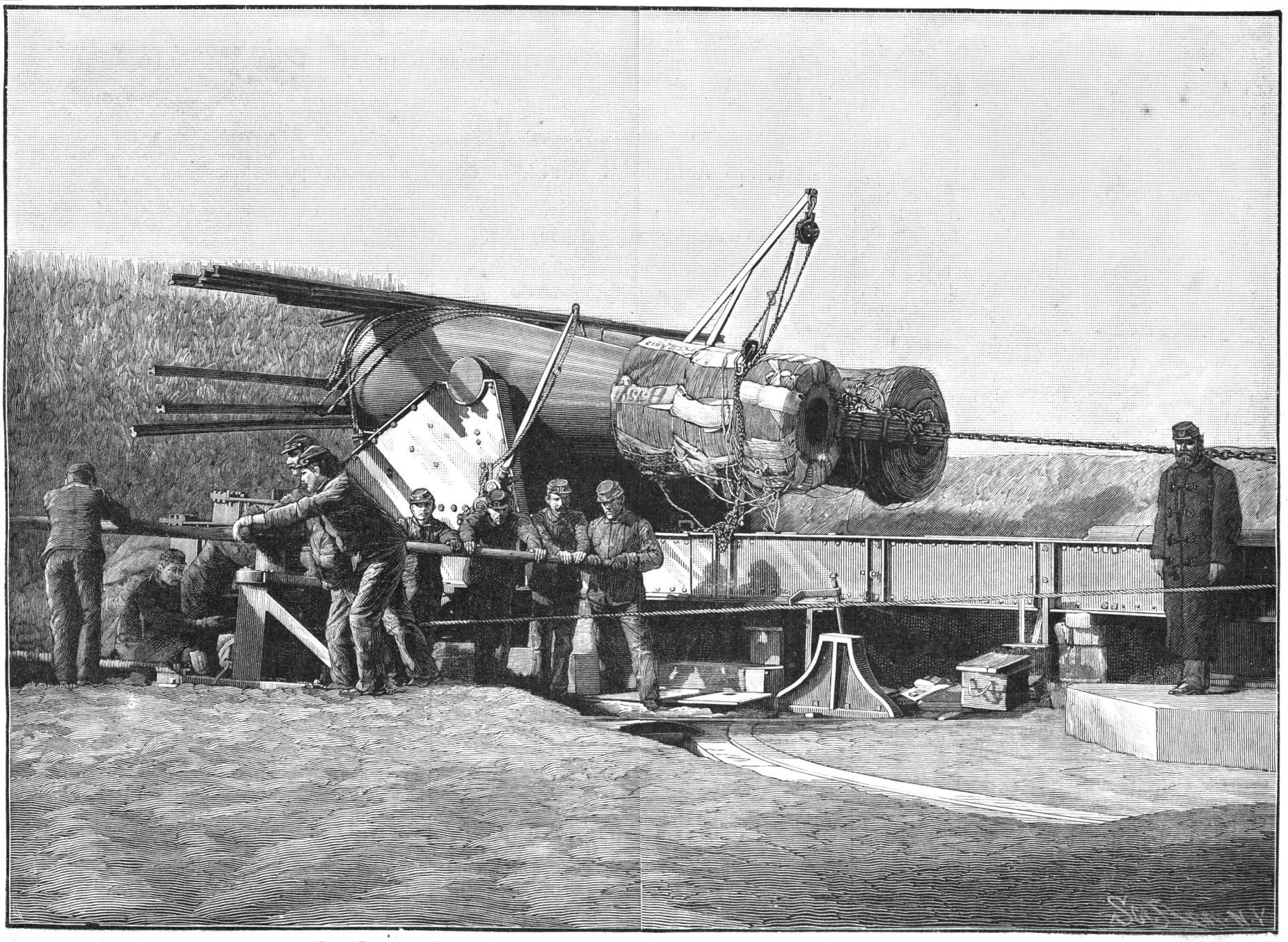
We are indebted to Major King for some excellent photographs of his remarkable apparatus, from which we have prepared the accompanying engravings. In one of the illustrations is shown a string of 15 inch shells, each weighing 320 lb., suspended by the magnetic force.

The wire used we understand was an old torpedo boat cable, consisting of 40 small insulated wires, forming a cable ⅜ of an inch in diameter. Major King gives us the following additional particulars:

"I have not completed all the experiments I intend to make, but owing to the lateness of the season the apparatus has been laid aside for the present. The guns were 15 inch Rodmans, weighing 50,000 lb. each, so that the entire mass of iron, including guns, carriages, armature, etc., must weigh about 130,000 lb. The length of insulated wire in the six coils was eight miles, and it was coupled in parallel on each gun and the guns in series. There was not wire enough on hand to give the length called for by theory, and it is quite probable that a different form of coupling would have given better results. The armature was made of 15 plates, each ½ inch thick and 11 inches wide, or 82 square inches cross section, and should have been at least twice as heavy, as also should have been the pile of rails that connected the guns at the breach.

"Nevertheless, the power of the magnet was enormous, as will be seen from the line of four 15 in. shells suspended from one





MAJOR KING'S GREAT CANNON MAGNET, AT WILLETS POINT, N. Y.

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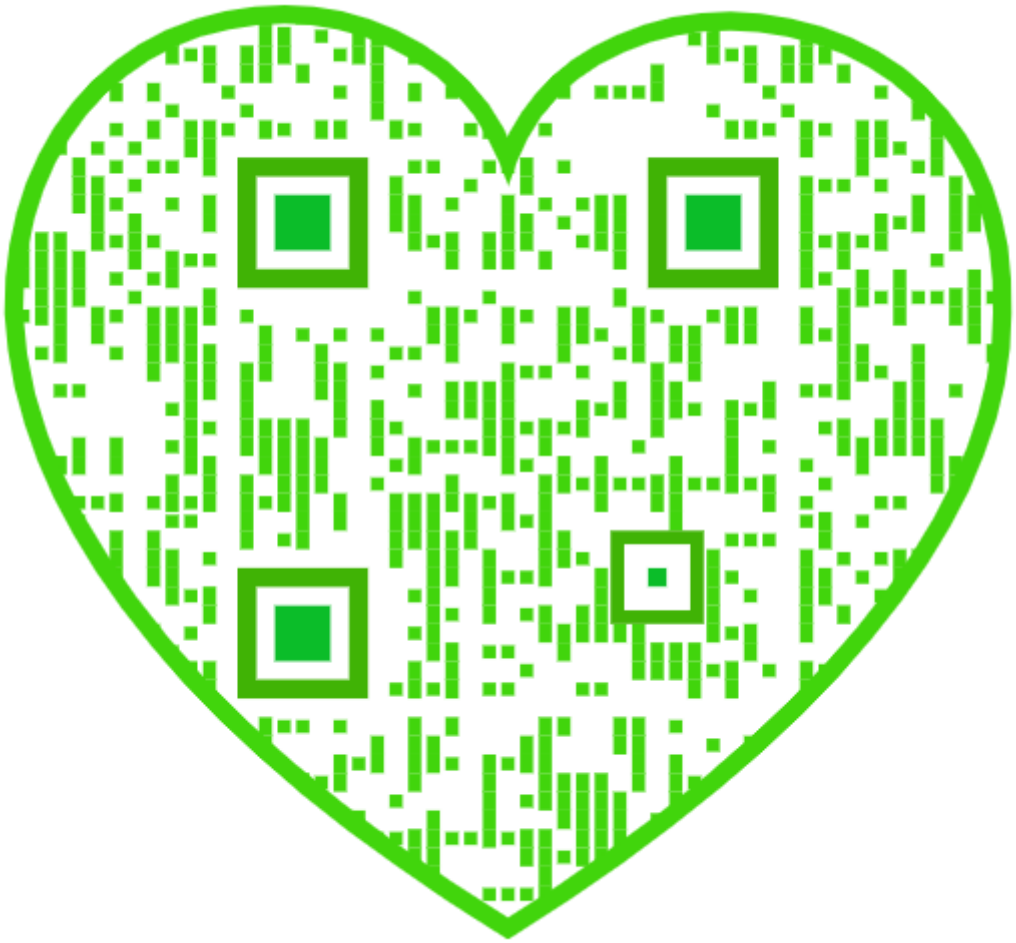

of the guns, and from the fact that it required a strain of 20,600, lb. to remove the keeper—when the current was on. The current was furnished by a 20 arc light Weston dynamo.

"The lines of force were very appreciable when a piece of iron was held in the hand, five or six feet distant from the poles, and some very interesting points were noticed, among which was a neutral point about 7½ inches from the face of the muzzle of each gun. Small pieces of wire were projected outward with considerable velocity, and then drawn back after reaching a point some two feet from the muzzle. Watches were of course stopped when accidentally brought near the guns."

The Sanitary Qualities of Artificial Butter.

BY JACOB R. LUDLOW, M.D., EASTON, PA.

The late Professor Hughes Bennett is quoted as saying that the great cause of the prevalence of pulmonary phthisis was the scarcity of good butter and the abundance of pastry cooks. The butter supply has always been inadequate. Years ago farmers and laboring men used pickled pork and bacon as fat foods, and butter only as a luxury. But nowadays everybody eats butter, whether he live in a shanty or in a palace, and the demand is so great that if we were dependent exclusively on the cow for our butter, the price would exclude it from the tables of all except those in comfortable circumstances.

Within a few years science and art have given us a substitute in oleomargarine and butterine. The skill and success that have been shown in its manufacture are quite phenomenal. It is really a triumph in its way. It is much better and more wholesome than much of the butter found in the markets. It has brought down the price of butter fully fifty per cent. The quality is uniform and the sources of supply inexhaustible. It is really a boon to the poor man and the man in moderate circumstances. Yet it is denounced and misrepresented by the dairy interest, because its extended use has diminished their profits.

It is called "stuff" and "nasty," and attempts are made to excite prejudice against it as unwholesome. Laws are passed taxing it, and more or less prohibiting its manufacture and sale. These laws and methods have chiefly one effect: they raise the price of butter, whether dairy or factory, on the consumer. They never will prevent its manufacture and sale. So long as men can make artificial butter which cannot be distinguished from dairy butter by sight, taste, or smell, so long will it be made and sold, and legal restrictions advance the price without diminishing the profits of its manufacture.

In the interest of the masses, I think the profession should protest against unnecessarily adding to the cost of a food so valuable and important. The rich man may enjoy his gilt-edged butter, but without this aid the poor man must be forced to use the inferior grades of dairy butter, strong, garlicky, carelessly made, and often unwholesome.

The wise fools calling themselves reformers, who, a few years ago, went about lecturing upon the injurious nature of fat as a food, did a great deal of harm in exciting a prejudice against fat ham, bacon, pickled pork, and other forms of wholesome fats; and now a delicately prepared fat, so closely resembling butter as to be easily substituted for it, is to be driven, if possible, from the market, for the sole purpose of adding to the profits of a special industry. Congress had better subsidize the dairy interest from the surplus in the treasury than to collect this additional tax directly from the people.

It is proposed to reduce the tariff on sugar. This would very likely not reduce the price of sugar to the consumer, and if it did, so much the worse. Sugar is too cheap already, and too much is eaten for the good of the public stomach, while a palatable fat food, which the people need, is discountenanced by a prohibitory price.

I have no interest, pecuniary or otherwise, in either dairy-made or artificial butter, but as a practitioner of medicine my attention is called to forms of food that may not make a recourse to cod liver oil so often a necessity.—*Medical and Surgical Reporter.*

AN illustration of the practical usefulness of bacteriology was furnished recently in this city. An Italian steamer arrived loaded with immigrants. There had been no cholera on board, but, as the vessel reached this port, a suspicious case of diarrhœa occurred in a child. The symptoms were not perfectly typical of cholera. Some of the dejections were taken, and sterilized tubes were inoculated and taken to the Carnegie Laboratory in this city. It would take four days to develop the cultures, and the question arose whether the steamer should be delayed for that period of time. It was finally decided to do so. The cultures developed in the way characteristic of Asiatic cholera, and the diagnosis was made. Subsequently other cases of cholera appeared, and the culture diagnosis was abundantly confirmed. But no more striking example of the utility of scientific studies could be furnished than the one referred to.—*Medical Record.*

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THE BARBED WIRE PATENT DECLARED INVALID.

This famous patent has at last been declared invalid in Circuit Court proceedings. The rights were founded on the Glidden patent, No. 157,124, dated November 24, 1874. Hitherto it has met with no legal reverses, though numerous attempts have been made to overturn it. The last decision, rendered by Judge Shiras, in Iowa, declares it void for want of novelty.

The grounds afforded by the proofs for the decision are interesting. They illustrate the precarious tenure of a patent under the existing laws, yet in the life of fourteen years that the patent has enjoyed, an adequate reward to satisfy the equities of the case has doubtless been reaped by the owners.

The defendants in the suit averred that as early as 1859 a prior inventor named Morley had devised a barbed wire fence, and had constructed and exhibited it at a fair in Delhi, Iowa. Witnesses were produced who swore that they had seen it. One had been injured by contact with the barbs; another one had his horse cut by them; the blacksmith who had made it testified clearly to such fact. A sample of the material about a foot long and with two barbs still attached was produced as the only piece left of the original wire.

The witness who averred that he had been injured showed the scars, and the fact of their presence on his face was entered on the record by the examiner. All this testimony related to a period now nearly thirty years past. The details of the testimony are quite dramatic. The record occupies about 10,000 typewritten pages.

This reversal of preceding judgments probably means that the patent is extinguished, practically, forever. The case has been appealed to the Supreme Court, but in the ordinary course will not be reached for three years. This will be within a few months of the term of the patent, and will end the whole question, except as regards the collection of arrears of damages.

Great rejoicing, it is said, will follow this decision. The farmers are supposed to be greatly benefited by it. The contrary is the case. They will receive no benefit worth mentioning as regards reduction of price. By the intelligent exploiting of the patent, which embodied undoubtedly a *bona fide* invention on the part of Glidden, the farming world was immensely enriched. The farmers, not the patentee or owners of the patent, have secured the greatest good from the cheap and efficient form of fence that it supplied. It would seem a hardship that the patent should expire on account of the unused and dormant invention of thirty years ago, were it not that large royalties have already been collected. Except for this, abstract justice would seem absent from the results of the recent trial.

The illustration the matter affords of the actual good done to communities by patents is valuable. In 1859 the wire was invented and shown in public applied to fence construction. But it was not patented, and hence nearly faded from human knowledge. But when a later inventor reinvented it and patented it, he became at once a benefactor to his kind. When patented, which, etymologically, means laid open to the world, it at once became one of the most valuable franchises the country has seen, the value of which was in exact relation to the good it did to the farming community; as they used it largely, they afforded a measure of its worth.

It is proper that if the proofs are good, the patent should expire. But it has during its life been a source of profit to the users of the fence, and not of injury. It has given them what they never had before, it has cheapened fencing immensely, it has solved the problem of inclosing the vast prairies of the West, and for the good it has done, the trifling royalties are but an insignificant remuneration.

THE DESTRUCTION OF THE GREAT LUMBER RAFT.

The great timber raft, whose departure from Nova Scotia was chronicled by us December 24, has gone to pieces and is irreclaimably lost. On December 8 the structure left its port in tow of the steamship Miranda. The ingenious nature of the construction adopted became evident at an early period of the trip. The captain of the towing ship found that if he relaxed his pull upon the tow lines in a seaway, the logs would work loose. This was the precise feature the patentee and inventor had striven to secure. All went well until a position south and east of Nantucket was reached. Here a severe gale proved too much for the two cables and connections with which it was towed. First, a fifteen inch steel hawser broke, and shortly afterward its companion pulled away the bits to which it had been secured. The raft was now entirely disconnected from the steamer, and in five minutes was out of sight. This occurred on December 17. The Miranda immediately steered west and reached her destination in safety.

As great fears were entertained for incoming vessels, which might be sunk by colliding with the raft, the navy steamer Enterprise and the revenue cutter Grant set out to find the raft and warn vessels of its possible proximity. The Enterprise was successful in her quest, as she found the debris of the raft. It was completely broken up, and the logs were scattered over an im-

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mense area of water. Every day will drift them farther apart. It is believed that there is now no danger to navigation to be apprehended.

This feature of easy destructibility when not towed is beneficial as regards the danger such a craft might be to ships if it was abandoned. It also emphasizes the need of a better arrangement for towing. Certainly, where so many thousand dollars were at stake, it would seem advisable to have two steamers connected to the center cable. On the maintenance of the strain on this cable the integrity of the craft is entirely dependent.

It is stated that the enterprising owner has not given up the idea of rafting timber by the ocean. Another attempt, it is anticipated, will be made next year. With sufficient provision for towing, and with fairer weather, there is not the least reason to doubt a successful issue.

DISCOVERY OF PLATINUM IN THE SUN'S ATMOSPHERE.

Professor C. C. Hutchins and Professor E. L. Holden, of the Harvard University Physical Laboratory, have begun a most interesting work pertaining to observations on the chemical constitution of the sun, which has already led to some remarkable results.

For the purposes of the new investigation they were supplied by Professor John Trowbridge with one of Professor Rowland's magnificent diffraction gratings, ruled on a concave of speculum metal, 21½ ft. radius of curvature, 14,438 lines to the inch, ruled surface 6 inches by 2 inches. The settings of the grating and of the photographic apparatus are such that the center of the photo-sensitive plate may be almost instantly set to within a single wave length of any given line in the spectrum.

For the purposes of spectrum comparison, a powerful electric lamp is used, the lower carbon being of cup shape. So intense is the heat that any ordinary compound placed within the cup is at once reduced to the metallic state.

The general arrangement and construction of the apparatus, as a whole, is such that any desired section of the sun's spectrum may be photographed on the upper half of the photo-plate. The sun light may then be shut off, and a photo made on the lower half of the plate of the spectrum of any substance inflamed in the electric light. The spectra thus obtained are then examined at leisure by a magnifying glass, and any coincidences between the solar and metallic lines noted according to their wave lengths.

The observations so far made by the authors convince them that the whole matter of coincidences of metallic and solar lines needs re-examination, and that something more than the mere coincidence of two or three lines out of many is required to establish even the probability of the presence of a metal in the sun.

The results obtained appear to cast doubt upon the existence in the sun of quite a number of elements before regarded as certainly existing in the great luminary.

An interesting result of these researches, described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 628, is the discovery of platinum in the sun.

The Tinning and Retinning Industry.

Tin is an almost silvery white, highly lustrous, non-elastic metal, softer than silver and harder than lead, malleable at ordinary temperature into thin tin foil, and so ductile that it can be drawn into fine, very flexible wire, which, however, breaks under a weight of less than one ton per square inch, and is so brittle as to be broken by a blow or fall. It is not appreciably affected in density by hammering, is fusible at 442°, burns in air at high temperature, with white light; is volatile at a very high temperature; comparatively indifferent to air or moisture at ordinary temperatures; and is a good conductor of heat and electricity.

The Romans employed tin for lining vessels of copper in which were cooked articles which would corrode the copper. Silver was also used for the same purpose, and afterward an alloy of lead and tin, known as pewter. The tinned vessels were known as *vasa stannea*. Pliny, referring to this tinning process, says the pure tin was always given the preference, the mixture of lead being considered a deteriorating adulteration.

The process employed by the ancient Romans was an immersion, similar to that practiced at the present day.

The art of tinning plate iron was invented in Bohemia, and carried from thence into Saxony in 1620, and other parts of Germany, whence all Europe was supplied until the end of the seventeenth century. The manufacture was begun in England, under Yarranton, in 1675.

Iron may be coated with zinc first, and then very readily tinned by dipping into the fused metal, since tin and zinc have a common affinity.

The process of tinning as used for small iron and other articles in Chicago shops is very simple. The articles to be tinned are generally immersed for a few minutes in a tub of dilute acid, then scooped into a wire basket, dipped into the melting pot containing pure molten tin, given two or three vigorous shakes, then taken out, and the contents dumped upon the floor or into a receptacle.

The principal business in the tin plating industry in Chicago is conducted by the Adams & Westlake Co. and the Chicago Stamping Co., and is confined wholly to what is known as "retinning." In the process of forming stamped tinware, flat sheets of metal are placed in powerful presses and forced by means of dies into shape. This shaping process and enormous pressure on the metal completely disintegrates the tin coating, breaking the fibers, and rendering the surface of the wares fractured, rough, and unfinished. This defect is remedied by replating, which reincorporates and reunites the surface, correcting all fractuosity, and making the ware bright and new. The ware to be replated is dipped into a caldron of boiling tallow, so hot that the original tin plating is softened up and melted from the surface of the sheet iron. Then the article so treated is dipped into a pot of fused tin, where it takes on a new coating of that metal. It is then dropped a second time into the grease pot, which has the effect of evenly distributing the coating of tin, taking off the superfluous metal. It is then put into a box of bran, where it is cleansed of the thickest of the grease, and finished by being rolled in flour and middlings, which completely cleanses the ware, leaving it smooth and bright.—*Amer. Artisan.*

Progress of American Railways.

According to the *Railway Age*, the year 1887 has surpassed all other years in the extent of railway mileage constructed in the United States. When, six months ago, the prediction was made in these columns that the total new mileage for the year "would not be less than 10,000 miles, with the likelihood of surpassing the record of 1882, the year of greatest railway construction in the history of the country," it was not generally believed. But the figures obtained by careful investigation throughout the year, and confirmed by official information, now prove the prediction to have been more than warranted. Our returns show that during 1887, 12,724 miles of new main line track were added to the railway system of the United States, no account being taken in this of the hundreds of miles of side track built, nor of the thousands of miles of main line tracks relaid.

While the search has been unusually thorough and the totals corroborate the record kept from week to week, it is not improbable that some scattering additions may yet be received, so that it is safe to state that during 1887 nearly, if not quite, 13,000 miles of new main line track were constructed. When, in 1882, during a period of extraordinary activity, 11,568 miles of new road were built, it was generally believed that these figures would not again be equaled. In the following year, 1883, the new construction fell to 6,741 miles, in 1884 to 3,825, and in 1885 to 3,608 miles.

The year 1886 witnessed a considerable revival of activity, and 9,000 miles of new road were built—a greater mileage than in any previous year with the exceptions of 1881 and 1882, and now 1887 has witnessed the building of more miles of railway than 1886 and 1885 combined, and not much less than 1885, 1884, and 1883 together.

The number of different lines constructed is surprisingly large, aggregating, after deducting for the duplicating of roads lying in two or more States, 364 lines. Of course the number of companies building these lines was very much less than this, but the new mileage consists of main lines and branches ramifying in all directions, and supplying facilities for transportation to innumerable communities and to vastly extended regions.

The greater part of this prodigious increase of railways has taken place in a few Western States. New England and New York contribute scarcely anything to the grand total. The great Middle States add very little, and the additions in the Southern States are not as large as many anticipated, although Alabama presents a fine record with over 500 miles, Georgia adds 230 miles, Florida nearly 200, and Kentucky and North Carolina each a little less than that. The Northwestern States have shown very considerable activity, but the great rush of railway building has been in the central belt west of the Missouri River. Kansas leads with the total of 2,070 miles. Nebraska comes next, with 1,101 miles, almost equaled by Texas, with 1,055 miles. Four States and two Territories—namely, Kansas, Texas, Nebraska, Colorado, Dakota, and Montana—together show an addition of over 6,400 miles, or about one-half of the entire year's mileage of the country. The only States from which no new construction is reported are Vermont, Connecticut, Rhode Island, and Nevada.

Many of the lines have been built through comparatively level country, requiring but little grading and bridge building, but, on the other hand, many other lines have been very costly. Moreover, several of the companies have purchased costly terminal facilities in large cities, while nearly all have made extensive purchases of equipment. It is probably fair to assume that the total cost of roadway, bridges, station buildings, terminal facilities, and equipment of these new lines averaged $25,000 per mile, at which rate it appears that not far from $325,000,000 have been expended on the lines completed during the year. But even this prodigious sum does not by any means cover all the outlay for new construction, as a large amount of grading and bridge building has been done on extensions where the track has not yet been laid. Evidently the work of the railway builder in 1887 has necessarily had a powerful influence on the financial condition of the country. The money which has thus been expended has temporarily employed a large army of workmen, and it has also furnished permanent employment to another great army, probably aggregating, at the average of five employes to a mile of road, about 65,000 persons.

The railway mileage of the United States at the commencement of 1887 was stated to be 137,986 miles. The extensions for the year here recorded increase it to 150,710 miles, and it may be said that, in round numbers, the United States to-day has 151,000 miles of railway lines.

Recent Naval Inventions.

Lieutenant Hovgaard, of the Danish navy, has made a notable addition to the literature of submarine and torpedo warfare in a book just published, in which he gives a description of a submarine boat which he has designed, which shall be able to dive below the surface at any moment, continue her course under water for a considerable distance, and remain there for many hours, retaining the while her capacity for continuing her work. For driving her machinery he employs steam above water and electricity in stowage batteries under water. The transverse section throughout the vessel is oval, the greatest axis being horizontal and the vertical axis just sufficient to give the necessary head room. The entrance is full, and the run long and fine. Such a form will give poor surface speed, but is the best for propulsion when totally submerged, while on the surface or awash her steering power will be very good, and the shape gives the utmost strength. Two screws sunk in protecting wells give vertical motion, while various ingenious arrangements of screw propellers, rudders, and pumps, all of them working automatically, preserve the direction, both vertical and horizontal, as well as the trim of the vessel. The cost of such a vessel the inventor puts at $250,000.

Lieutenant Boyer, of H. M. S. Malabar, has recently been experimenting in telephonic communication at sea. The signaling apparatus of his invention consists of a gong fixed against the side of the vessel below the water line. A straight tube leads from this gong to the bridge, and in its interior is a rod, by which the hammer can be worked, and the striking may be in accordance with the Morse code. In the center of the gong is fixed a telephone, connected by means of wires running up the tube to a second telephone on the bridge. This forms the receiver. If two ships be fitted with this combination, it is maintained that it is only necessary for one to rap out her message by striking her gong and for the other to receive it on her telephone. The sound waves from the transmitting gong traverse the intervening water and vibrate the diaphragm of the submerged telephone at a distance. These vibrations excite currents in the latter, which, in traversing the second or observing telephone, reproduce the original sounds.

Is Clay a Mineral?

A most curious suit was recently presented before the English House of Lords for adjudication, in which the above question was the issue. The corporation of Glasgow purchased some land at Westham for water works and conduits, and erected thereon a reservoir. In the deed there was a clause included that stipulated for the seller a reservation of "the whole coal and other minerals." Coal seems not to be present underneath the reservoir, but merchantable clay is there, and to it the representative of the original vender lays claim, The land in the immediate vicinity has been worked for clay almost up to the boundary of the reservoir, and the right of extending the workings regardless of their effects upon the corporation's structures is claimed. Various decisions have been reached in the Scotch courts, and now the case has at last reached the final tribunal. The contestant offers to relinquish his title to the clay for the modest sum of £10,000, only £1,000 less than he originally received for the property.

The scientific fact that clay is a mineral is admitted, and also, under the railway clauses act, it is conceded that it may be considered such. The Scottish courts present at least a majority of opinion against the corporation. The point that clay is an ore of aluminum strongly indicates that it is in the economical sense a mineral. It will be interesting to see whether the Scotch baillies will prove to have been outwitted by an over-clever seller.

FLEXIBLE MUCILAGE.—To 20 parts of alcohol add 1 part of salicylic acid, 3 parts of soft soap, and 3 parts of glycerine. Shake well, and then add a mucilage made of 93 parts of gum arabic and 180 parts of water. This is said to keep well, and to be thoroughly elastic.

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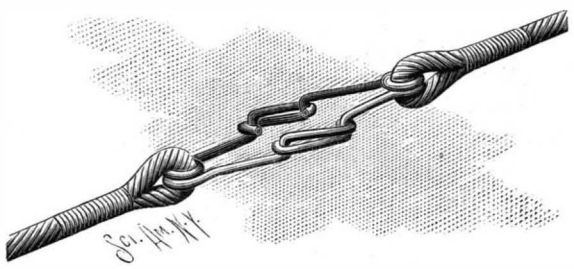
AN IMPROVED BELL CORD COUPLING.

A simple, inexpensive, and durable bell cord coupling, intended to avoid the liability of breaking glass in the cars where it is employed, and one which can be quickly and easily coupled and uncoupled, is illustrated herewith, and has been patented by Mr. Thomas H. Sheldon, of Fair Play, Col. It consists of a single length of light spring wire coiled to form a loop, through which the bell cord is passed, with hooks at

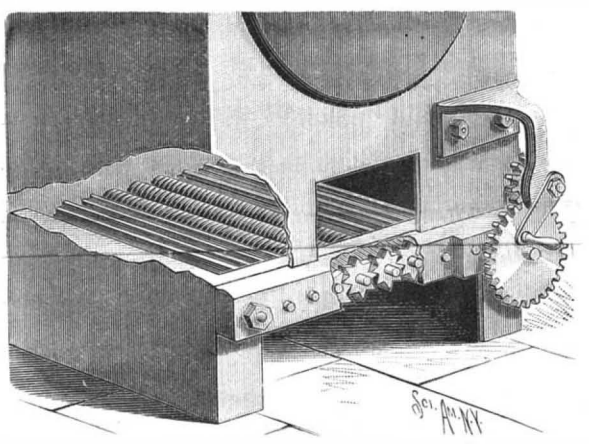


SHELDON'S BELL CORD COUPLING.

its free ends, shoulders being formed between the loop and the hooks. The wire sections are intended to be so light that there will be no danger of their breaking the glass, while their cost will be very low.

AN IMPROVED FURNACE GRATE.

An improved grate for the furnaces of steamboat, locomotive, and stationary boilers is represented herewith, and has been patented by Mr. Jerome De Pereira, of No. 41 First Avenue, New York City. The grate bars are journaled in the front and back walls of the furnace, the side bars being fluted longitudinally, and the central bars fluted circumferentially, gudgeons extending from both sets of bars through the front wall of the furnace. Upon the gudgeons are pinions which mesh with each other and form a train of gearing for revolving all of the grate bars from a single crank shaft. The fuel is fed upon the circum-

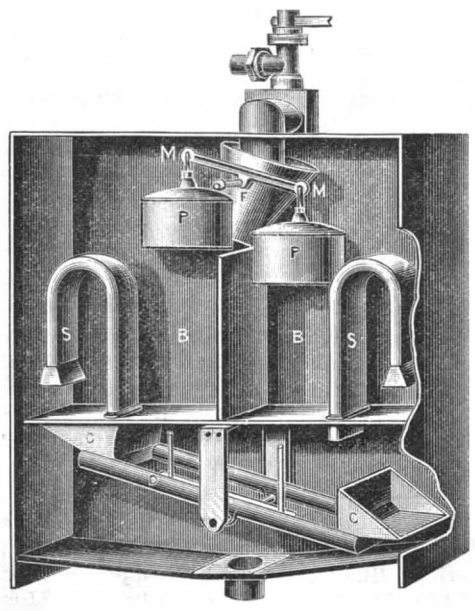


DE PEREIRA'S FURNACE GRATE.

ferentially fluted bars in the center of the furnace, whence it is gradually shifted upon the side bars, the comparatively small proportion of ashes forming in the center easily passing down through the bars, while all the small or fine fuel is retained. At the sides of the furnace, where there will be presumably less fine fuel and more ashes and clinkers, the latter are readily discharged into the ash pit, the crushing action of the longitudinally fluted grate bars readily breaking up the clinkers.

THE SIPHON WATER METER.

The siphon water meter aims at combining the accuracy of the positive action type of instrument with the cheapness of the inferential class. The liquid is delivered into a chamber of known capacity, which it fills up to a certain level. Immediately this level is reached, the supply is cut off from that chamber and



THE SIPHON WATER METER.

directed into a second, while at the same instant the first chamber commences to discharge its contents, the act of delivering tilting a beam which is connected to the counting apparatus. Thus the index tells the number of times the chambers have been filled and emptied, or the number of gallons which have passed through the meter.

The emptying of each chamber is effected by a siphon. The water gradually rises in the short leg until it reaches the bend, and when it has attained this level it commences to flow down the long leg, and thus starts the exhausting action. If, however, the chamber is fed drop by drop, or by a mere trickle, there is a possibility that with a siphon of ordinary construction the feed may all leak away without the siphon coming into operation. To prevent this the bottom of the long leg is sealed by a small bucket at the end of a tumbling beam. Should the water leak over the bend, it will be caught at the bottom of the long leg until sufficient has accumulated to tilt the beam, when it will escape, at the same time putting the siphon into action.

The details are clearly shown in the annexed engraving. B B are the two measuring chambers, which are filled and emptied between the levels marked by the mouths and bends of the siphons, S S. These are of flattened section, as it is found that with this form the exhausting action is more certain. In a compartment below the chamber is the tumbling beam, D, carrying a bucket, C, at each end. This beam is maintained in an inclined position by the weight of water in its interior until the siphon above its elevated end begins to discharge, when the bucket at that end fills and tilts the beam, bringing the opposite bucket into position. This beam is connected with an upper beam, K, which moves with it. This latter beam works the counting mechanism, and also carries a chute or funnel, F, which directs the incoming water first into one chamber and then into the others. In large meters there are two plungers, P P, connected to the upper beam. The descent of one of these into the chamber which has just filled its bucket and is tilting the beam, D, insures the certain action of the siphon by raising the level of the water over the bend.

This meter was shown at the late Manchester exhibition by the makers, Messrs. W. & B. Cowan, of Smith Square Works, Westminster, and also of Manchester and Edinburgh.

It is well made, wonderfully simple, and will, no doubt, work for a long time without attention. As compared with a piston meter, it is claimed to be equally accurate and less expensive both for first cost and maintenance.—*Engineer.*

Pyrofuscine.

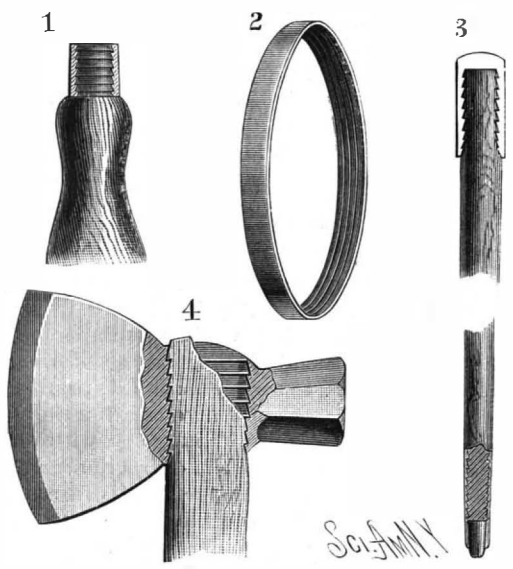
Can coal be a residual of an industrial process? The question may be asked in respect of the Reinsch patent tanning process, the employment of which is reported to be spreading in Germany. In this system a compound known as pyrofuscine, which contains carbon, hydrogen, and oxygen, and appears to belong to the class of humic bodies, is extracted from coal by treatment with boiling alkaline solutions. In practice, the coal, finely powdered, is digested with boiling caustic soda, and when the liquor is neutralized with hydrochloric or nitric acid, the new tannic agent is disengaged from the solution. It can be obtained in greater or less proportion from most coals and lignites, but not from anthracite. It possesses great chemical stability; and, unlike other known humic bodies, it resists chemical reagents and light. Its weak or concentrated solutions, although exposed to the air for a long time, remain unaltered. The alkaline solutions of pyrofuscine are strongly antiseptic, which property is utilized in tanning hides.

Machine belts tanned with pyrofuscine resist destroying agencies better than those prepared with tan and alum. Wetted and dried many times, exposed to the sun, and kept in dry or damp air, these hides perfectly preserve their strength, elasticity, and fiber. At the same time the process is a cheap one. It may be asked, however, what is the composition of the coal after the pyrofuscine has been extracted from it, and whether it or the tar from its carbonization shows any noteworthy alteration as a result of the alkaline lixiviation. Pyrofuscine may be experimentally made by boiling several times 4 or 5 lb. of coal in a solution containing 100 grammes of hydrate of sodium. The liquid will contain from 2 to 3 per cent of pyrofuscine, and neutralized with an acid will yield from 25 to 30 grammes of the substance weighed in the moist state. If well washed in water, it is unchangeable by acids.—*Jour. Gas Lighting.*

NOT far from Hyde Park, Mass., there is a setter dog which has a peculiar way of making known its desire for food. When hungry, it will go to the coal hod and pick up a piece of coal and lay it at the feet of the mistress of the house, and if that does not bring the food, it will get another piece. On one occasion the dog's patience was taxed to the utmost on purpose, and it nearly emptied the coal hod.—*Wade's Fibre.*

AN IMPROVED FERRULE.

A ferrule which is designed to remain firmly attached to the article to which it is applied, even if the wood or other material should shrink, has been patented by Mr. Charles P. Hawley, of No. 510 West 153d Street, New York City, and is shown herewith, Fig. 1 showing it as applied to a tool handle, Fig. 2 as embodied in a barrel hoop, Fig. 3 as applied to the cap and ferrule of a cane, and Fig. 4 as used in the eye of an ax. The

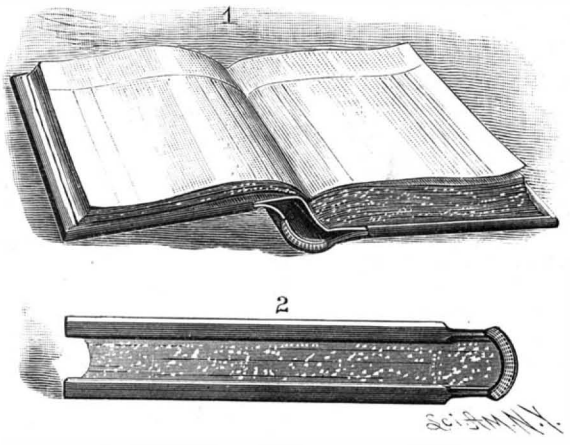


HAWLEY'S FERRULE.

invention consists in ridging or serrating the inner surface or bore of the ferrule, cap, band, or eye with a series of parallel notches, the notches being cut into the ferrule in a manner to form inclined faces and a corresponding series of shoulders, which range preferably at right angles to the bore of the ferrule. The forcing on of a ferrule, hoop, or eye, so formed, momentarily compresses the material, but allows of its subsequent expansion, when the fiber enters the notches and makes a firm hold, the ferrule differing from a screw-threaded one in that it is not liable to come off with the shrinkage of the material over which it is attached.

AN IMPROVED METHOD OF BOOKBINDING.

A binding for books which allows the leaves to be opened out flat at any part of the book, without strain upon the back or the threads or cords which hold the leaves, is illustrated herewith, and has been patented by Mr. George Huether, of No. 57 Cedar Street, New York City. The covers are formed in two parts or thicknesses of pasteboard or other material, the outer thicknesses of each cover being less in width than the inner, and connected to the spring back by flexible connections, the inner thickness of each cover being con-



HUETHER'S BINDING FOR BOOKS.

nected to the inner binding next to the back of the leaves. The spring back has flexible side pieces attached to the covers between the inner and outer thicknesses, these side pieces, when the book is open, permitting the inner edges of the inner thicknesses to lift slightly away from the spring back, so that the inner binding will have greater freedom, thus enabling all the leaves to be opened flat without strain upon the binding or leaves.

TWO new turret ships are about to be laid down in Cronstadt for the Black Sea. They will be sister ships, in almost all particulars alike. Their displacement will be 8,000 tons. For protection of center of ship and machinery, steel armor 20 inches thick will be used, decreasing to 10 inches toward the keel. The breastwork and turret armor will be 16 inches. They will be armed with four 12 inch guns in each turret, and will carry in addition four 9 inch guns, eight Gatlings and a torpedo apparatus. Against such vessels as these our proposed armorclad vessel would be a puny antagonist. Why the United States should build vessels with 12 inches of armor when other governments are not satisfied with less than 20 inches is a question worthy of attentive consideration.—*Army and Navy Register.*

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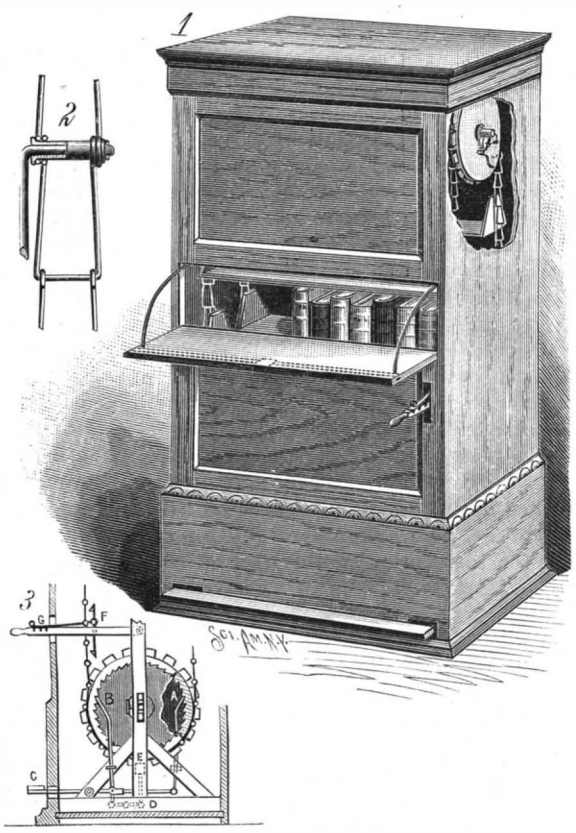
IMPROVED ARRANGEMENT OF MOVABLE SHELVES.

A method of suspending pendulous shelves from endless carriers, whereby any of the shelves will be easily accessible without changing one's position, is illustrated herewith, and has been patented by Mr. Francis V. Comfort, of Stillwater, Minn. Fig. 1 shows such shelving arranged within a case, Fig. 2 is a detail view of one mode of suspending the shelves, and Fig. 3 is a sectional side elevation, showing how the carrier is operated. The endless chains or carriers, from which the shelves are suspended, run over upper and lower sprocket wheels, the ends of the lower shaft being vertically adjustable. The carriers are chains formed of U-shaped links, at the intervening joints having their free ends looped over short gas pipe or other tubular sections, with flanged ends to hold them in place. For raising and lowering the shelves by hand, either direct pressure may be employed or the hand lever, G, to which is pivoted a spring arm, carrying at either end reverse pawls, F, adapted to engage the links of the chain. For operating the shelving by foot, a tread, C, is connected with spring pawls, A and B, engaging with internal circular pawls on either end of the bottom carrier shaft, either pawl to be thrown into engagement with its respective ratchet for raising or lowering the shelves by pressing the tread to the right or left, when the shelves are either raised or lowered, as desired, by working the tread vertically. The working of the tread also operates a lever, D, to move a counterbalance weight, E, which normally acts on a pin to prevent all movement of the shelving when the shelves have been arranged in the desired position. In applying this improvement to small or medium sized bookcases, the latter will ordinarily have a transverse partition, or "false back," between the front and rear, to render the front shelves alone visible.



COMFORT'S MOVABLE SHELVING.

Anti-Vaccination.

The success of the anti-vaccinationists is aptly shown by the results in Zurich, Switzerland, where, for a number of years, until 1883, a compulsory vaccination law obtained, and small-pox was wholly prevented—not a single case occurred in 1882. This result was seized upon in the following year by the anti-vaccinationists, and used against the necessity for any such law, and it seems they had sufficient influence to cause its repeal. The death returns for that year (1883) showed that for every 1,000 deaths 2 were caused by small-pox; in 1884, there were 3; in 1885, 17; and in the first quarter of 1886, 85.

AN IMPROVED GAS PIPE WRENCH.

A simple and very powerful wrench, specially adapted for gas pipes, and designed to fit all sizes of pipes, is illustrated herewith, and has been patented by Mr. John M. Haynes, of Maxwell, Cal. It consists of a lever, on one end of which is fulcrumed a griping jaw having a segmental toothed edge, a chain being secured by one end to the lever, and adapted to be hooked by one of its links between the inwardly curved prongs or hooks on the free end of the griping jaw. The chain is usually drawn as taut as possible before being hooked by its link, and thus a pipe of any ordinary size can readily be operated upon, as the chain is hooked in position according to the respective sizes of pipe.

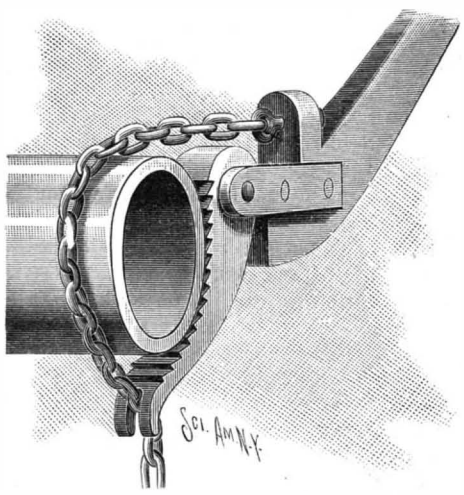
AN IMPROVED FARM AND ROAD WAGON.

A vehicle gear which is especially designed to facilitate building a low-down wagon on high wheels, and in which the line of draught will be directly from the center of the wheel, is illustrated herewith, and has been patented by Mr. Edward A. Gardiner, of Mullica Hill, N. J. On the under side of each straight axle is held a downwardly extending truss, by means of hangers supported by the axle, the outer ends of each truss being connected together by a strengthening rod. In the middle of the truss on the forward axle is a recess for the reach held on the axle by the usual king bolt, and on the top of the axle is the bolster with the usual standard on each end. The several parts are preferably made of wrought iron and cast steel, principally the latter, and are so arranged below the axle that the wagon bed can be placed from six to eight inches lower than in the usual style of wagon with as large a wheel, while by this system of truss bracing the axle is not liable to spring.

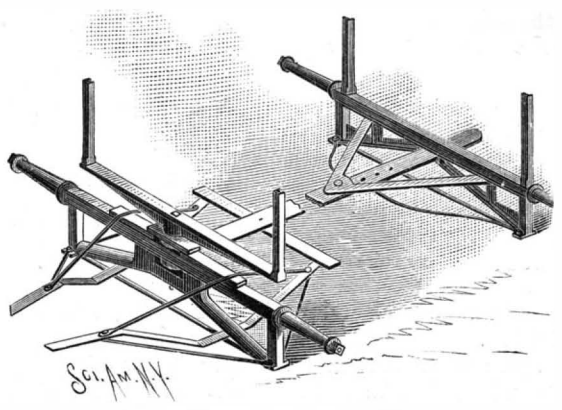
TWENTY-FIVE TON CRANE.

We illustrate a Goliath crane designed for raising concrete blocks, weighing 25 tons, and intended to be employed in the construction of harbor works in one of the Grecian islands. The framework is entirely of wrought iron. The main struts are of the box girder type, and support double girders crossing the top and carrying the chain sheaves. The whole structure is well tied and trussed with cross girders, struts, and gusset plates. The cradles are of box girder form with recesses left for the traveling wheels.

The load is raised by a double sheave snatch block, the chain passing over sheaves fitted on the top cross girders, and being coiled on a spirally grooved barrel. The gearing is double purchase, with a factor of safety of about 10 to 1. A powerful brake is fitted which controls the full load at any point of lowering. Massive cast iron side frames are fitted to planed wrought iron joists machined to fit the main framework. These frames carry the whole of the gearing, chain barrel, etc., and allow the machinery to work with a minimum of friction. Hand lifting gear is applied to work with the other gearing, so that four men can raise the full load. A ratchet and pawl is fitted to this gear to prevent the load running back, and the brake is also made available for lowering by hand when required.



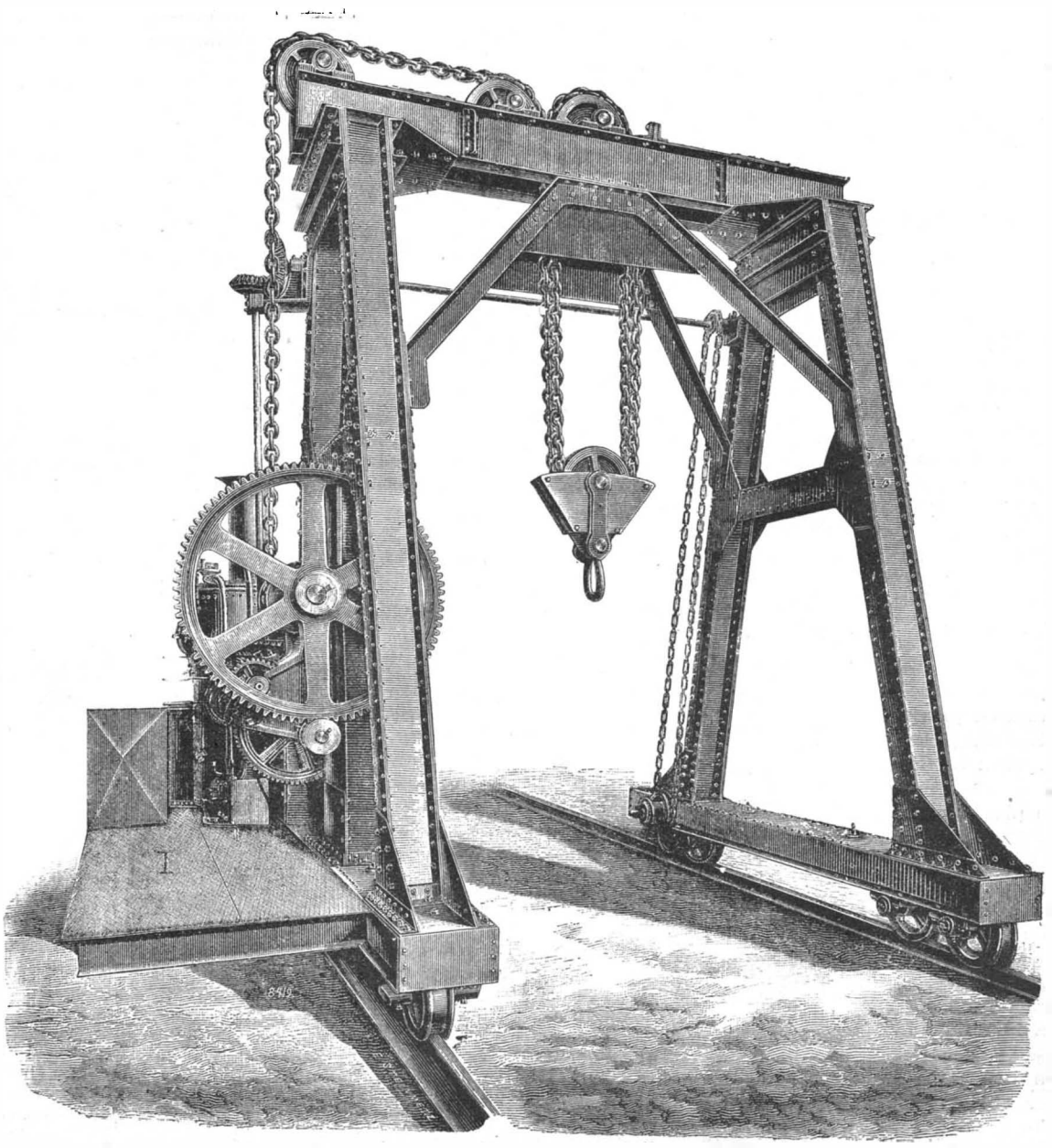
HAYNES' WRENCH.



GARDINER'S VEHICLE GEAR.

The traveling gear is driven from the crankshaft of the engines by bevel wheels and cross shafts, connected by steel pitch chain to gearing, which is fitted to the cradles. A clutch for working this gearing is fitted on the crankshaft, and clutches are also fitted to the lower part of the gearing to allow of the crane being moved by hand, handles being also provided for this purpose. The traveling wheels are in pairs, four pairs in all. One pair in each cradle are ordinary flanged wheels, without gearing, the pair at the opposite end of each cradle being geared and driven by pinions actuated by the steel pitch chain driving chain wheels fitted to the pinion shafts.

The driving and lifting power consists of a pair of vertical engines of ample size, arranged on an independent planed and machine-fitted wrought iron framework, in order that any strains, due to working or bad roads, shall not affect the working parts of the engines. The engines are fitted with an improved form of reversing motion, which has for some time been adopted by the constructor of this crane for all kinds of crane engines, in order to lessen the number of working parts and to obviate the unsatisfactory results obtained by using link motion for small engines. The lever for this motion, together with all the other levers for the crane, are brought to one spot to enable the attendant, without any change of position, to have the whole of the levers, as well as the brake, under complete control. A spacious



TWENTY-FIVE TON GOLIATH CRANE.

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wrought iron checkered plate platform is supported on girders attached to one of the cradles, and upon this is placed a vertical cross tube boiler for supplying steam to the engines. A feed water tank and a coal bunker are fitted at the side of the boiler.

The crane was tested before leaving the works, and careful observations were made as to the frictional resistance of the chains, gearing, engines, etc., when raising and lowering the full load of 25 tons. Under these tests the coefficient was found to be remarkably low, mainly due to the care that had been bestowed in preventing strains on the main framing affecting the bearings and working parts.

The crane has already been erected at its destination, and reports which have come to hand show that the design and workmanship have met with the fullest approval of the government officials and the contractor for the works. The mode of working is to lift the concrete block, weighing 25 tons, high enough to admit a truck under it. The block is then lowered on to the truck, and is pushed by hand on to a strong wrought iron pier truck, which is fitted with hand propelling gear and brakes, and runs on a line of rails laid at right angles to the lines upon which the crane and truck run. The rails for the pier truck are laid on a lower level, so as to facilitate the transfer.

The pier truck is then worked down to the pier head with its load by the hand gearing, and on reaching the head of the pier the block is lifted by a floating crane, consisting of a powerful derrick attached to the forward part of a barge and worked by a steam winch of unusually large proportions, combined with suitable blocks and chain, and is then lowered into the sea on stone and rubble foundations already prepared.

As soon as the crane has completed loading one line of blocks it is traveled on to the pier truck and taken to the next line, repeating the operation until the whole yard is cleared.

The pier truck, slings, chains, blocks, and other lifting machinery, together with the Goliath crane, which we illustrate, have all been manufactured for this contract at the works of Mr. Henry J. Coles, Southwark, London.

When these harbor works were first contemplated, plans, specification, and tender were asked for a block-setting titan which would lift the blocks from the yard and travel bodily with them to the pier head. Mr. Coles' design for this crane was approved by the ministry, and instructions were given for the titan to be ordered, but for various reasons it was afterward decided to use the plant forming the subject of this notice.—*Engineering.*

Photo-Microscopic Stereographs.

There are innumerable bodies in the world of small things which can only be properly observed, so as to realize their configuration, by a binocular microscope; and in the case of such objects, no matter how much they may be enlarged by photography in the usual way or with what perfection their detail may be rendered, they still afford a very inadequate idea of their form.

Our object at present is to point out, briefly, some methods by which the possessor of an ordinary monocular microscope may be enabled to photograph any suitable object with all the relief as seen in the finest binocular instruments, and this, too, without incurring much expenditure for costly appliances. Premising that the method to be described is intended for employment with low powers, we shall explain its principle of action by a simile we employed many years since, when we had occasion to introduce it to the notice of our readers of those days. Let a bust or statuette be placed on a table at a distance of a few feet from a single fixed camera, and a negative be taken. Now, without moving the camera, rotate the statuette on its axis in the slightest degree, and then take a second negative. Prints from these two negatives will, when mounted side by side on a stereoscopic card mount and examined in the stereoscope, show the image in all the solidity that could be desired, the amount of relief being determined by the extent to which the original object was rotated previous to the second negative being taken. Reasoning from analogy, we now proceed to apply this system to the production of micro-stereographs.

The object slide must not be placed flat down directly on the stage of the microscope, but upon a secondary or super stage so constructed as to allow of the small platform upon which rests the object slide to oscillate from right to left within a limited sphere. The one we constructed for the purpose is made of thin brass, pivoted at its two sides into guiding side pieces, the axis of motion being adjusted so as to coincide with the object to be photographed. Having focused the object, and using a diaphragm in front of the objective so as to increase its penetration, the first photograph is taken, when the little seesaw slide holder is tilted to one side, after which it is tilted to the opposite side preparatory to making the second exposure. The amount to which the tilting takes place must be only very slight, else the apparent solidity of the image when subsequently examined in the stereoscope will be exaggerated.

Success in this is insured by employing an objective of small angular aperture, or, should it be too wide, limiting this otherwise excellent quality by a diaphragm cap being slipped over the end.

Another way by which stereoscopic photo-micrographs can be obtained by a monocular microscope is to employ an objective having an effectively large front lens and covering it with an easy fitting cap, having in it an aperture so much at one side as to cover up one half of the lens. When making the first exposure, the cap is turned so as to uncover one side of the lens, and is rotated half a turn before taking the second negative. The resulting pair of pictures will be stereoscopic.

There are several other methods which may be employed, and which are more especially adapted for the higher powers. This article is, however, mainly intended for the photo-microscopic aspirant with limited appliances.—*Br. Jour. of Photo.*

Land Torpedo Boats.

The question as to whether machine guns should be attached to cavalry seems at last to have settled itself affirmatively, and we may hope soon to see their proposed issue an accomplished fact. When, some three years ago, it was suggested by Lord Charles Beresford to use the machine gun as a "land torpedo boat," he had in his mind's eye a light well-horsed weapon that could dash on with the advanced cavalry of a force to seize important advanced points, or that could dart from point to point of a battle field as its services might be required. In accordance with this idea, a strong, light two-wheeled carriage was designed, which carried a Nordenfelt three-barreled gun, mounted on a double limber box, with room for one man sitting on each side of it. It was drawn by a pair of horses, one of which carried the driver. This gun was thoroughly tested in every way by the 10th Hussars, under the superintendence of Colonel Liddell and Major Wilson, and latterly by the 13th Hussars, in the hands of Captain Baden-Powell. Several improvements were added, and new guns have within the last four months been issued to the cavalry regiments at Aldershot. These are now being put through an exhaustive trial as to their mobility and accuracy, and their detachments through a course of training in their use. Ever since the idea of their adoption was first mooted, objections have from time to time been urged and freely argued, and recently a discussion took place in the theater of the Royal United Service Institution, which may be said to have asserted finally the necessity for their adoption as a service weapon. On this occasion it was proposed, in a very able lecture by Lieut. Benson, R.A., that a limbered ten-barreled Nordenfelt gun should be adopted as the service machine gun, to be organized and worked on the battery system. An interesting discussion followed, in which some of the speakers strongly pointed out that were this system to be introduced, the whole idea of the "land torpedo boat" would be lost. Whether or not such an arm as that proposed by Mr. Benson should be started as an additional branch in our service remains to be determined by the development of events; but that it should take the place either of the cavalry galloping machine gun or of the portable infantry weapon is an idea not to be entertained. The very different nature of the action of cavalry from that of other arms demands a special form of weapon for it. As one of the speakers pointed out, cavalry action as compared with that of infantry or artillery differs as a Frenchman's style of fighting from a Briton's. The one hits out fair and square, while the former endeavors to disable his adversary by a sudden and unexpected kick on the shin. Cavalry relies for success on the suddenness and sharpness of its attack, and for such tactics the present gun is pre-eminently adapted. When one takes into consideration the various duties of cavalry in modern war, it must be confessed that a machine gun of equal mobility must almost at any time be of very great assistance to it. Thus, when covering the advance of an army into an enemy's country, such a gun would be most valuable in assisting to seize and hold advanced posts, defiles, bridges, etc., until the arrival of re-enforcements. Among outposts it will add to the strength of the pickets, especially at night, by sweeping the main lines of approach open to the enemy.

In action, when the opposing lines are advancing against each other, the gun may gallop to the front and flank and knock a gap in the oncoming enemy's line in a few seconds. In the defense of posts or in street fighting it would not only materially assist the power of the carbine fire of the dismounted men, but would also tend to render the presence of so many of them unnecessary—would do away with the bad economy described by Colonel Brabazon as "an endeavor to make the best cavalry in the world into indifferent foot soldiers." With rear guards the value of machine guns could not be overestimated. For sudden harassing of the enemy's flanks and lines of communications, convoys, etc., the insignificant appearance of the gun will enable it to get almost anywhere unnoticed, and to come into action at most unexpected times and places, with immense moral as well as practical effect. But for these duties it is imperative that the gun should be of the most mobile mounting, capable of rapid movement over bad ground, able to come into or to cease from action almost without a pause, and that it should be always on the spot with the cavalry. These vital points would be lost were a corps of limbered machine guns established in lieu of the galloping cavalry guns. The action of machine guns in the above class of work is one of momentary opportunity. There would seldom be time to send off to the nearest troop of the machine gun corps for the desired assistance, the limbered gun with its four horses would only make its way indifferently well in bad or inclosed country as compared with that on two wheels, and would attract the attention of a watchful enemy before it had time to wheel up, unlimber, and come into action; and on the slightest hint of a counterstroke by the enemy, it would have to limber up and get away sooner than the cavalry gun, which can maintain its fire up to the last moment, and continue firing even in retreat if necessary. But to get the most out of such a gun, it is very desirable that its points be thoroughly recognized, and as thoroughly instilled into those deputed to work it. A wise step to this end has been taken in establishing a class at Aldershot for instruction in the uses of the new weapon. —*Broad Arrow.*

Dangers of Overhead Electric Wires.

In New York, recently, people passing along the east side of Union Square, about 9 o'clock in the evening, were attracted to a small but brilliant pyrotechnic display made by one of the telephone wires crossing Fourth Avenue at Fourteenth Street.

Suddenly a spark larger and more brilliant than any of the others flew from the wire, and a team of horses drawing car No. 137 of the Fourth Avenue line, which was passing under the wire at the time on the uptown track, began to dance and prance about.

One of the horses the next moment dropped to the pavement as though it had been shot, and the driver noticed that the thin telephone wire was broken and wound round the animal's legs and neck.

He jumped from the car and was about to tear the wire from his horse's neck, when Officer Kaieser, who happened to see the occurrence, held him back.

It was then discovered that the horse which had fallen was dead, and the deadly character in the broken wire thus being demonstrated, there was a lively scattering of the crowd in all directions. Officers Kaieser and Hass succeeded in taking the harness from the live horse, and saved it from the fate of its mate.

Travel was delayed on the Fourth Avenue line for over a half hour. Finally a man came along with a ladder, and with a huge pair of rubber gloves on his hands. He climbed the ladder, which the policemen held as far from the dead horse as possible, and cut the wires.

The circuit was thus broken and the danger removed. The horse was quickly hauled from the track and travel resumed.

The accident was caused by the telephone wire falling upon the electric light wire, and becoming impregnated with the strong current of the latter.

Telegraph Line across the River Luan-ho.

The extension of the Chinese telegraph system has involved the crossing of several large rivers—a matter of no small difficulty, owing to the enormous dimensions of the summer floods. The river in question, whose ordinary width is about half a mile, is swollen by the rains to a breadth of more than eight miles, and quite recently a large village situated nearly five miles from the western bank was completely destroyed by the overflowing torrent. Heavy cables have been used for these crossings, but their lives have been of short duration, due partly to the *debris* brought down, partly to the constantly changing river bed. It was therefore decided to divert the land line some 19 miles, taking it to higher ground, where the river was naturally more restricted as to its channel, and effect the crossing by means of a wire rope. The extremities of the rope at the position selected are respectively 447 and 737 feet above the level of the river, the distance to be spanned being 1,549 yards. The line is supported at either end by stout wooden posts some 14 feet high and 14 inches diameter at the top. These posts are firmly stayed and guyed by steel ropes. In consequence of the exceedingly heavy strain, it was found necessary to employ granite blocks about 4 feet in circumference as insulators. A similar wire rope crosses the river Kistna at Bezarrah, in the Madras Presidency, having a span of 1,690 yards; there are two across the Ganges with spans of 966 and 943 yards; the Hooghly is crossed by a line of 711 yards; and in the United States a wire rope of 666 yards crosses the Missouri. The Chinese aerial line is consequently the second longest. The wire rope was manufactured by Messrs. Siemens & Company, of London. It is composed of seven steel wires stranded, each wire 0·145 inch diameter.

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J. B. Dancer.

We are indebted to the *Manchester Guardian* for the following particulars of Mr. Dancer's life:

Mr. Dancer was born on October 8, 1812, in London, and may be said to have been born an optician, his father and grandfather having been makers of optical and scientific instruments. In 1818 his father, Mr. Josiah Dancer, removed to Liverpool, where he carried on the business of optician and philosophical instrument maker. In 1835 the father died, and the business was afterward carried on by the subject of this notice. After a few years Mr. Dancer removed to Manchester. He was the first to suggest the application of photography to the magic lantern, and he also improved the arrangement of the optical parts, producing a clearer image and a flatter field than had before been obtainable. A list of the instruments, apparatus, and processes in the invention or improvement of which Mr. Dancer has been concerned is too considerable to reproduce here. We have only space to mention the most important. In 1838 he suggested the introduction of earthenware porous jars to separate the two solutions in voltaic batteries, which before this time was done by means of bladder or other animal tissue. In the same year he invented a still more important instrument, viz., the automatic contact breaker, or the vibrating interrupter—an instrument which is absolutely indispensable at the present day wherever electricity is employed for telegraphy or signaling. Again, in 1838, and resulting from the same experiments, came the deposition of metallic copper by voltaic electricity. This was the very beginning of electro-plating, of which art Mr. Dancer was really the inventor, though others have run away with the credit of it. In 1841 he commenced microscopic photography on daguerreotype plates, and this wonderful art he perfected in 1852, when the introduction of the collodion process much simplified this and every other photographic process. In 1853 Mr. Dancer invented the twin-lens stereoscopic camera; that is, a camera with two lenses placed side by side, at a short distance apart. Omitting several other instruments which Mr. Dancer improved, we must mention his connection with Dr. Joule in his renowned heat experiments and discoveries. Dr. Joule found the necessity for accurate thermometers, and with Mr. Dancer's assistance determined to make them for himself. The result was the production of a new thermometer, "the first made in England with any pretensions to accuracy," as stated by Dr. Joule himself. Mr. Dancer also arranged the apparatus for measuring the internal capacity of the bore of thermometer tubes. Of Mr. Dancer's connection with the microscope, Professor W. C. Williamson thus wrote a few months ago:

"Mr. Dancer successively brought out several forms of instruments, as excellent in their mechanical and optical arrangements as they were moderate in price. Instruments fully equal to the requirements of original research were thus brought within the reach of many whose observing faculties were more conspicuous than their financial resources."

After such a catalogue as this, one would in the ordinary course of things suppose that we should have to record that Mr. Dancer had died one of the most wealthy men of his time. Unhappily, he died one of the poorest. Too modest for business push and flare, he kept in the background while others gained by his labor; too unselfish to look after paying business, he "wasted," as it may perhaps be termed, time on the scientific interests of others—time and effort which might have been turned to his own profit. Any scientific man, if finding himself confronted by a difficulty, has gone, all through the last forty years, to Mr. Dancer as to an encyclopedia. Days absorbed in this way had to be made up by nights spent over the microscope, and in the end Mr. Dancer lost his most precious possession—his eyesight—not suddenly, but little by little. With the failure of his sight, business also began to fail, and a few years ago the old shop in Manchester had to be shut up. Then a few gentlemen came together, an appeal for subscriptions was issued through the papers, and very quickly a few hundred pounds were raised. From that time the small income that has come from this fund has been Mr. Dancer's only means of living. The story is one of the saddest it has ever been our lot to chronicle.

Large Silver Nuggets.

General A. G. Greenwood (says Mr. G. F. Kuntz) recently called my attention to a nugget of native silver weighing 606½ ounces troy, one of sixty that have been found at the Greenwood group of mines, in the State of Michoacan, Mexico.

The other nuggets weighed from one to thirty-five pounds each. The large nugget is entirely worn except in cavities, where some of the crystals are rounded and the form is still visible. It is almost pure silver, scarcely a trace of any gangue rock being discernible. This specimen was found on the surface, and in its original state is said to have weighed 12 pounds more. It is one of the most remarkable nuggets of silver ever found. The geological formation is a limestone with outcroppings of limonite.

Curiosities of Telegraph Construction in Mexico.

Like the land of Grecian fable, Mexico is a paradise girt with fire, says Frederic R. Guernsey in the Boston *Herald*. There are at least three distinct climates—that of the Tierra Fra, or Cold Land, up in the mountains; that of the Tierra Templada, Temperate Land, on the plateau, and extending down the slope toward the coast a few score miles; and, lastly, that of the Tierra Caliente, or Hot Land, which takes in the coast on the Pacific and Atlantic sides with also some of the sloping country.

The Tierra Templada is at the north of the country, characterized by the vast treeless plains, over which must be hauled by railway, or by cart where the railway does not penetrate, the poles and wire for the lines. Oftentimes great loads of poles, cut in the forests around Toluca or Paizcuaro, in the southern part of the republic, have to be slowly and laboriously hauled over the hot plains of Chihuahua and put in place by men who carry their rations for days with them. The cost of the poles and the wire is necessarily greatly enhanced by the transportation, and it may be said that telegraph wire, placed almost anywhere in Mexico, costs the government three times what it did landed at Vera Cruz or Paso del Norte.

Travelers on horseback in northern Mexico traversing these vast, treeless, and melancholy plains stop at night for camp, and, finding the telegraph poles accessible and admirably seasoned, cut them down for firewood. And this is not all. The humble ranchero, desiring a stock of wire with which to fence in an inclosure, goes with his peon servants and cuts down a mile or two for use, leaving poles oftentimes prostrate. I have myself seen poles wireless, and also long stretches of wire without poles.

And the poles brought so far at so great an expense have other enemies besides man. There is the insignificant-looking worm, the "jengen," which insidiously honeycombs the poles till some fine day they fall at the breath of a breeze, strewing fragments of wood over the ground. This is a formidable opponent of telegraph communication in Mexico, and any bright American who can show how to keep it out of the poles may fairly demand a reward from the Mexican government.

"Y los pajaros son enemigos tambien" (and the birds are also enemies). There is a Mexican woodpecker who sits up toward the top of the poles and pecks and pecks for whole days, till the top comes off, and wires and cross arms go too. A great rogue is this Mexican woodpecker, the sworn enemy of telegraph poles. The linemen (celadores) shoot him when they can, but of what use? One dies and forty come after to the funeral!

And then the white ants, those industrious, unseen hollowers-out of timber! These tiny creatures will eat out the inside of a pole till it is a mere shell, solid apparently, sturdy seemingly, but absolutely as good for nothing as an eggshell. Up comes the wind, and the poles blow away as if they were hornets' nests detached by a cyclone. These "hormigas blancas" dig out the inside of house timbers in some parts of the country. They have even been known to so hollow out the legs of a dining table that one day down it came with all its crockery and the noonday meal, too. The hormiga blanca is also the sworn enemy of civilization and progress as represented by the telegraph.

But the Hot Land has its enemies of telegraph also. How Mayne Reid or Ballantyne or Verne would have seized on the facts here presented! Picture to yourselves, good friends on seaside piazzas or lounging on mountain tops this summer day, a country of impenetrable vegetation, with gigantic palms and plantains, with jungles so dense that it is hard work with a stout and sharp machete to make a path through them, a country of intense heat, of innumerable mosquitoes, and ticks, and malaria, and snakes, and vegetation that grows up in a day to a height that interferes with the labor of man.

Such are some parts of the Mexican states of Tabasco and Yucatan, and it is through such regions that the telegraph which connects the Mexican capital with important points like San Juan Baptista or San Cristobal must penetrate. This is country where the linemen go in couples, and armed with rifles to fight off the fierce "puma," or Mexican tiger (tigre), who assaults man and is especially ravenous for telegraph constructors! The Mexican linemen down in the hot coast country shoot many a puma while out attending their lines.

A scarcely less formidable antagonist is found in the monkey tribe which inhabits the jungles and chaparral of Tabasco. Literally, "the woods are full of them." Their favorite diversion, when not in quest of food, is to betake themselves to the telegraph line for gymnastic exercises, and linemen assert that often one hundred able-bodied monkeys may be seen swinging on the wire, festooned, monkey fashion, by looping their tails. The continuous vibration of these forest gymnasts starts the iron nails used on the cross arms, and these often come down, bringing the wire with them.

And it is not a safe matter to undertake to disperse these robust monkeys who play the dickens with the telegraph lines in the sparsely inhabited state of Tabasco. Linemen have found that on shooting a monkey swinging on the wire they have been pursued by a whole regiment of monkeys. "It is no joke (*no es broma*)," said a lineman recently, "to have a tribe of monkeys pursue one; they are very strong (*muy fuertes*) and can hit with a stone or a stick in a fashion to make a man howl with pain, a thing the monkeys enjoy hugely."

In the coast country, especially on the Gulf of Mexico side, the wires, from the humid condition of the air, oxidize rapidly, and a wire is found by experience to be in need of replacement in a year's time. This adds heavily to the cost of keeping up the service.

Still another difficulty in maintaining a good service in the Hot Land States is the impossibility of acclimating, in many regions, telegraph operators from the colder table lands. They easily fall a prey to fevers, and, if they escape with their lives, they have been absent from their posts and the service has suffered. So it has been found necessary to make use of natives of those regions, often imperfectly educated, and from whom much must be borne, perforce, for they make blunders with fatal facility and try the patience of the city of Mexico officials to a degree.

Speed of Atlantic Steamers.

The returns for the present fiscal year, which have just been issued by Mr. Nicholas M. Bell, the Superintendent of Foreign Mails in the Post Office Department at Washington, give some information regarding the speed of Atlantic steamers which will be read with interest by those who took an interest in the recent discussions on the mail contracts. The Americans have a special reason for observing and recording the time taken by the various steamers to cross the Atlantic, for they send their letters by the fastest vessels only, altogether irrespective of their nationality or of the particular line to which they belong; and it is therefore necessary that the information on which they base their information should be thoroughly complete and accurate. From an engineering point of view, moreover, as well as from a postal, the statistics are worth a little study. These give the time occupied in the conveyance of mails during the twelve months from New York to London, and perhaps the most striking feature about the list is the distance of time separating the boats at its extreme ends. The Cunard liner Umbria heads the list with an average time of 187·5 hours, while the Wisconsin, belonging to the Guion Company, which stands at the foot, requires 258·1 hours to perform the same passage, being a difference of very nearly three days. The second on the list is the Umbria's sister ship, the Etruria, with 188 hours. Next in order comes the North German Lloyd steamer Trave, with an average of 199·3 hours, and the Anchor liner City of Rome, with 203·4 hours; while the Alaska, of the Guion line, and the Aller, of the North German Lloyds, compete very closely for the fifth place with times of 205·3 and 205·7 respectively. Then we have a considerable number of North German liners with approximately equal times, the average of which is very nearly the time taken by the Cunard liner Aurania. Then follows the Servia, of the Cunard line, with 211·2 hours, and then the White Star liners put in an appearance—the Britannic, with the time of 219·8 hours; the Germanic, 228 hours; the Adriatic, 230 hours; the Republic, 235 hours; and the Celtic, 236 hours. The best of the Hamburg-American line takes 240·7 hours, while almost at the bottom stand the Inman liners, the quickest of which, the City of Chicago, takes 241·6 hours; and the slowest, the City of Chester, requires 256·8 hours. It is probable, however, that the new boats now being built for this latter company and for the White Star line will completely change their positions in the list.

Polygonal Locomotive Wheels.

A locomotive possessing several unusual features has been recently built by the Hinkley Locomotive Company, of Boston. The engine is designed to run fast passenger trains, and has a single pair of drivers, 67 inches diameter on tread, and a pair of 42 inch trailing wheels with radial motion. The front end of the engine is carried on a four wheel truck as usual. The engine has piston valves, but the most novel feature is the form of the tread of the driving wheels. The circumference of the tire, instead of being a true circle, is polygonal, and formed of 105 flats each about 2 inches long. The object is to prevent slipping. The engine has not yet been tried, but it is claimed that polygonal tires have been running on a four-coupled engine on the Boston & Lowell during the last year with satisfactory results.

A flat wheel is generally regarded as damaging to the rails, while the motion of an engine or car with flat wheels is exceedingly unpleasant. Whether any extra adhesion will be gained seems doubtful, but even this means of preventing slipping would certainly, according to all preconceived notions, be more objectionable than the use of sand. However, such a bold departure from time-honored practice deserves a fair trial, and should not be condemned till actual experiment has demonstrated that flat wheels have no redeeming feature.—*Railroad Gazette.*

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SNAKES IN INDIA.

Although a European is seldom bitten by a snake in India, the danger is always present to everybody's mind, owing to the large number of natives who die from bites and to the constant sight of the reptiles. Indeed, snakes always form a fruitful source of conversation at an Anglo-Indian dinner table, when other topics are scarce, and a goodly flow of stories, theories, and doubtful incidents in natural history may invariably be reckoned upon when "snakes" are started.

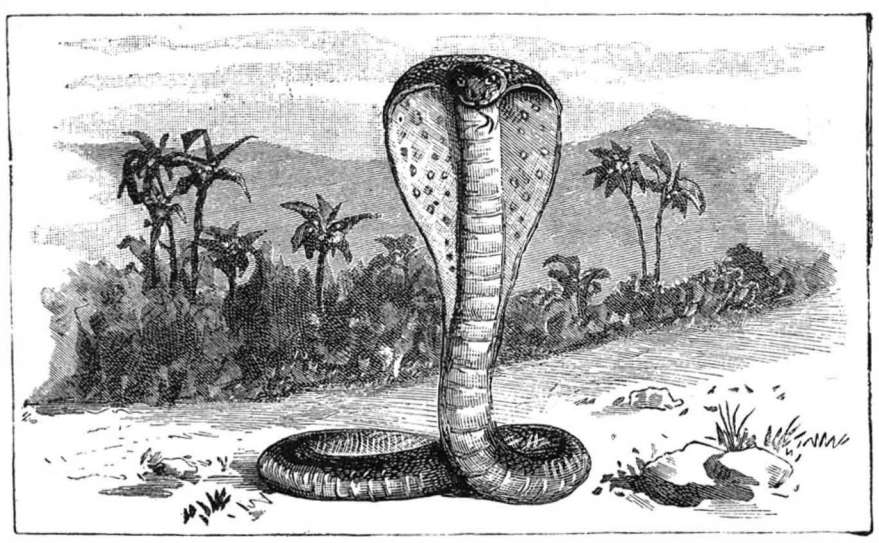
Our illustrations are from sketches by the late Captain W. W. Robinson, Royal Engineers, who died at Aden on June 7 last. In an interesting article, for which we regret that we cannot afford space, he remarked that the "Griffin" is always carefully instructed by his moonshi in snake lore, including the habits of the whipsnake, "who whips and whips you till you die."

"It was during one of his lessons," Captain Robinson continued, "that I first saw snake charming. Parties of natives carried round baskets slung at the end of bamboos, and, squatting down in front of the veranda, offered, in a jargon as peculiar to them as the squeak is to a Punch and Judy man in England, to get up a 'very good dance.' The lids of the baskets were opened, and two or three cobras were unceremoniously pulled out. Then, while a squeaky pipe was played, the snakes raised their heads, spread their hoods, and assumed the oft-pictured attitude. As the musician menaced them with his hand, they ducked their heads up and down, and this was the 'very good dance.' Then another of the party produced an unhappy, ragged looking mongoose (ichneumon), the traditional enemy of snakes, and a so-called fight was shown by alternately throwing him on to the snakes and jerking him back again by the string round his neck. There was not much 'charming' in the treatment of the cobras, who probably had had their fangs extracted. There are, I believe, however, authenticated accounts of men who handle unmutilated cobras.

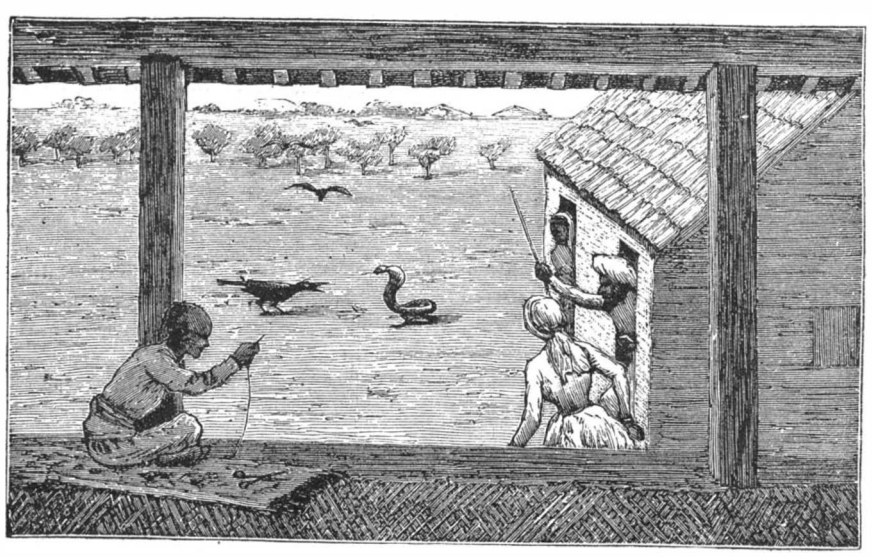
"The occasion of a river being in flood is usually a time of snake harvest for the naturalist, as the snakes are either washed up, drowned, or else driven from their holes to take refuge on high ground. During one flood I found two cobras up in the branches of a thorny acacia tree. The largest of the two we attacked, and killed with long bamboos. He was over five feet long, and the biggest cobra I have ever seen.

"Our poultry used to get very excited when a snake was about. The crows and other birds would similarly show its vicinity by flocking together near him in a state of much perturbation. On one occasion my wife was irritated by the continuous scolding croak of a crow. When she went out to drive him away, she saw a large cobra striking angrily at him. The crow danced about just out of his reach. My wife and the servants, taking the snake in the rear, decided the contest much to the cobra's disadvantage. On one of our police sepoys being bitten, I found, on examining his foot, the unmistakable mark of the two fangs of a poisonous snake. I gave him some brandy, extemporized a rough tourniquet, and was proceeding to carry out the government instructions for snake bite. The man himself, however, and his companions thought he ought to go to the representation of a Mussulman saint at a neighboring mosque, and while I was finding a razor they carried him off. Next morning, on making inquiries, I found the man was alive, though very sick. The holy saint had repeated prayers over him, had bound a pebble on his right arm, which was only to be removed by the holy man himself, after eight days, with appropriate prayers. If taken off by any one in the interval the man would die. In a few days the sepoy was well, the saint removed the bandage and pebble, and I was appealed to as a witness to a veritable miracle. Had I not seen the bite and testified that it had been caused by a venomous snake?

"It is seldom one hears of a European being bitten. I only know of two authenticated cases while in India. One was bitten by a cobra belonging to some snake charmers, whose fangs he thought had been extracted. The other had touched with his foot what looked like a whip lash, but which was in reality one of the little Indian vipers (*Echis carinata*), a specimen of which I show in one of my sketches. Both cases recovered. The immunity enjoyed by Europeans is doubtless due to the fact that they wear boots in place of the sandal depicted; but even so one wonders that there are not more cases, when it is reckoned how often a snake is found in a bungalow."—*The Graphic.*

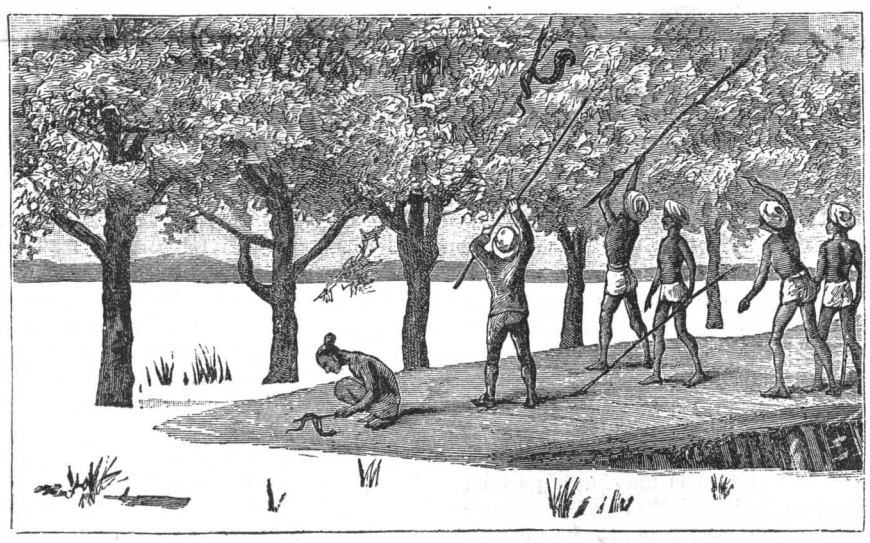


A COBRA.



COMBAT BETWEEN COBRA AND CROW.

COBRA CHARMERS.



DURING THE FLOODS.

THE EAST INDIAN COBRA.

Early Britons.

In a paper read at a recent meeting of the British Association, Dr. J. G. Garson described the discoveries of General Pitt-Rivers at Rushmore, near Salisbury, where he has found the remains of no less than four British villages of the Roman period, besides many tumuli and cists. The human remains are extremely interesting, and throw much light on the characters of the people to whom they belonged. The chief point of interest which they show is the small stature of the people, the average of the males being 5 feet 4 inches and of the females 4 feet 11·8 inches in the village of Woodcuts; while in that of Rotherly, the other village excavated last year, the heights are 5 feet 1 inch and 4 feet 10 inches respectively. The skulls are of a long, narrow, oval form, with one or two exceptions, when they are of rounder form. These were found associated with longer limb bones, showing them to be of different race from the majority of the inhabitants. Two forms of skull are frequently met with in long barrows, both of a long, narrow shape, but differing from each other in one having a regular oval outline, while the other broadens out from a narrow forehead, and, having attained its greatest width, terminates rapidly behind. The skulls found in these villages correspond exactly to the first type. It is therefore probable that there were two distinct races of the long-headed people, which will have to be distinguished in future.

Drink Legislation in Austria.

The Austrian government have, it is stated, introduced into the Reichsrath a strong measure for the prevention of drunkenness. The reason alleged is the alarming deterioration in the physique of young men enrolled for military service, owing to the spread of spirit drinking among the humbler classes. It will be interesting to see if the provisions of this measure are accepted. They would be difficult to carry in this country, where freedom even to get drunk is still jealously guarded. Spirit shops are to be closed at five on Saturday afternoon, and to remain so till five on Monday morning. Ordinary storekeepers are not to be allowed to sell spirits, the sale of which is to be restricted to public houses, confectioners, and specially licensed stores. Dealers serving spirits to intoxicated persons are to be liable to arrest or fine. No debt for spirits consumed on the premises can be recovered by law if the amount exceeds the value of five liters. The magistrates are empowered to forbid retailers to serve spirits to habitual drunkards for any period up to twelve months. Similar legislation already exists in Galicia. The proposal now is to extend it to all Austria. The preamble of the measure sets forth that it is a direct outcome of the hygienic congress. It is a striking illustration of the impotence of our own Parliament that no legislation for the restriction of our enormous drinking habits has any chance of being entertained.—*Lancet.*

Trial of an Electric Street Car—Julien System.

On December 8, a street car with a Julien secondary battery as the source of electricity was tried upon the Fourth Avenue railroad in this city. It was filled with a party of invited guests. While many of the arrangements were provisional, it ran twice over the line, sometimes attaining quite a high speed. The battery carried was said to be enough to drive it forty miles. The maximum speed attained was about ten miles an hour. It started at 32d St., ran to 85th St., and down to the City Hall Park, and then returned to the depot at 32d Street.

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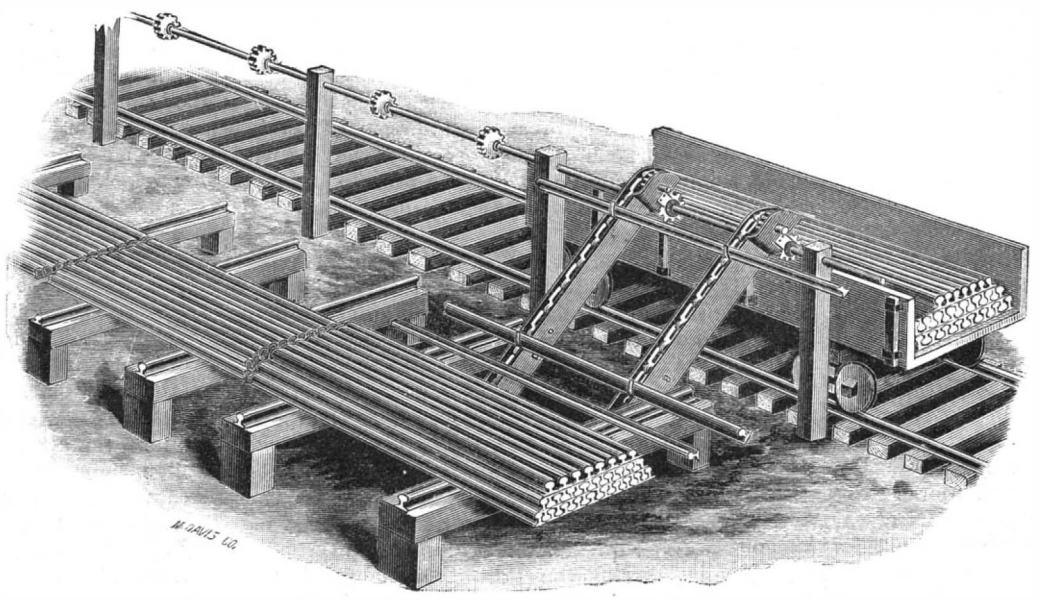
IMPROVED RAIL LOADING MACHINE.

A rail loading machine, by the use of which rails may be loaded into cars cheaply and expeditiously, has been patented by Cyrus P. Tittle, of Johnstown, Pa. A cut and description of it are herewith given. While to a limited extent machinery has been used for loading rails, this machine, being portable, presents a feature not possessed by others, in which there must be duplicate machinery for each bed or pile of rails, or all the rails must be loaded from one pile. This can be moved from one rail pile to another, and when not in use can be taken out of the way.

The machine consists of two plates bolted together, having a short shaft with a cog wheel and sprocket wheel attached running through the upper end, and a similar shaft with sprocket wheel running through the lower end. An endless chain, with hooks at regular intervals, engages with the sprocket wheels. In front of the rails to be loaded, a shaft having fast to it cog wheels in pairs, as many as desired, is supported at a suitable height from the ground. Two of the loaders are used, and are placed with the lugs or supports on the under side of the plates, resting on the shaft in such manner as to have the cog wheel of the machine engage with the cog wheel on the shaft. Power is applied to the shaft and motion consequently imparted to the chain. As the rails are brought to the front of the pile, the hooks elevate them to the top of the machine and tip them into the car. If the car is not of the same height as the machine, suitable sliding bars can be arranged to conduct the rails into the car.

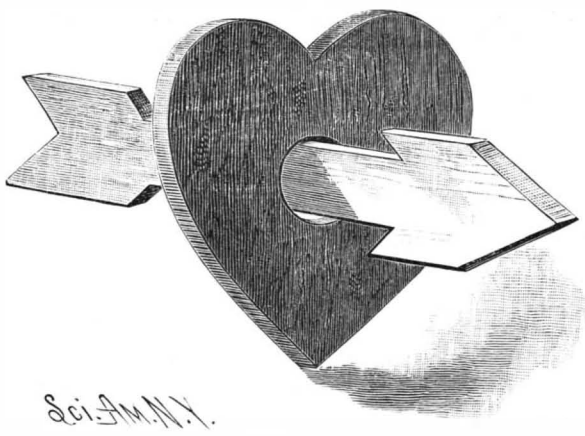


IMPROVED RAIL LOADING MACHINE.

NOVEL PUZZLE.

Our engraving shows a single perforated piece of wood having the form of a conventional heart, and in the perforation is inserted an arrow, also formed of a single piece of wood, the barb and head being much larger than the perforation in which the shank of the arrow is received. The heart is made of one kind of wood and the arrow of another. The question is, How did the arrow get into the heart? We have heard of the philosopher who was unable to rightly place a horse collar, and we have seen philosophers who could readily harness a horse, but who could not explain how the arrow got into the heart.

The puzzle illustrated is one of many thousands distributed gratuitously upon the streets of New York as an advertisement. The heart is of black walnut and the arrow is of basswood. Now we fear that the secret is out, for any one familiar with the properties of basswood knows that it may be enormously compressed, after which it may be steamed and expanded to its original volume. One end of the arrow was thus compressed, and in its compressed state was passed through the aperture of the heart, after which it was expanded. Advantage has been taken of this principle in the manufacture of certain kinds of mouldings. The portions of the wood to be left in relief are first compressed or pushed down by suitable dies below the general level of the board, then the board is planed down to a level surface, and afterward steamed. The compressed portions of the board are expanded by the steam, so that they stand out in relief.



A NOVEL PUZZLE.

Charles Loudon Bloxam.

Mr. Charles Loudon Bloxam, who for many years held the professorship of chemistry in King's College, London, and was formerly lecturer at the Royal Military Academy, Woolwich, died on November 28, aged fifty-five years. Mr. Bloxam's original researches, contributed mostly to the Chemical Society, were of a highly technical character. As far back as 1853 he devised methods for the analytical separation of tin, antimony, and arsenic; and he subsequently investigated the action of boracic acid upon the alkaline carbonates and alkaline earths. The poisonous metals claimed a good deal of his attention; he suggested an electrolytic test for the presence of arsenic, made a special study of the compounds of arsenious acid, and investigated the source of the arsenic which occurs in the sulphuric acid of commerce. In conjunction with Sir F. A. Abel, about thirty years ago, he conducted researches on the valuation of niter. Mr. Bloxam was the author of a well known manual of chemistry and of some smaller works on the metals.

APPARATUS FOR THE ELECTROLYSIS OF WATER.

T. O'CONOR SLOANE, PH.D.

The apparatus shown in the cut accompanying this article is intended to demonstrate that water disappears when electrolyzed, and to afford an approximate measurement of the amount decomposed. It forms a very good appendix to the ordinary experiment of decomposing water by the electric current and collecting the evolved gases separately. The amount of water corresponding to a large volume of electrolytic gases is so very small that the most delicate means have to be adopted to render it perceptible, unless a very strong current is used, and a long time occupied in the decomposition.

The apparatus consists essentially of two tubes, one the decomposition tube and the other a funnel tube. Their general shape is apparent from the cut. The decomposition tube is twelve inches high. The large portions are three-quarters of an inch in internal diameter. The connecting portion is made of capillary tubing. This may be from one-sixteenth to one-sixty-fourth inch bore. To this a scale is attached. It may be made of paper or pasteboard and secured by gum tragacanth. The funnel tube is six inches long, and its long stem is made of the same capillary tubing as that used for the other. It communicates by an India rubber tube with a lateral outlet leading from the decomposition tube.

Two plates of platinum are inserted at opposite sides of the lower portion of the decomposition tube, and a good cork is driven in to retain them. A portion of each plate projects downward, lying against the side of the cork outside of the tube. If an ordinary cork is used, it is well to insert with it a lump of sealing wax or paraffine. Then, when the cork is forced in well, the wax or paraffine is melted so as to be completely fluid, and is allowed to solidify while the tube stands vertically. This must be done while the tube is perfectly dry. If a very good and soft India rubber cork is used with thin plates of platinum, the treatment with wax is unnecessary.

This method of inserting the plates is given because it is the easiest. It is advisable to bend them a little inward, so that they will not lie against the glass. But it would be still better to secure them to platinum wires, which, by a good glass blower, could be passed through the glass tube above the cork, and there melted in place. Care in either case must be taken to see that they do not touch each other.

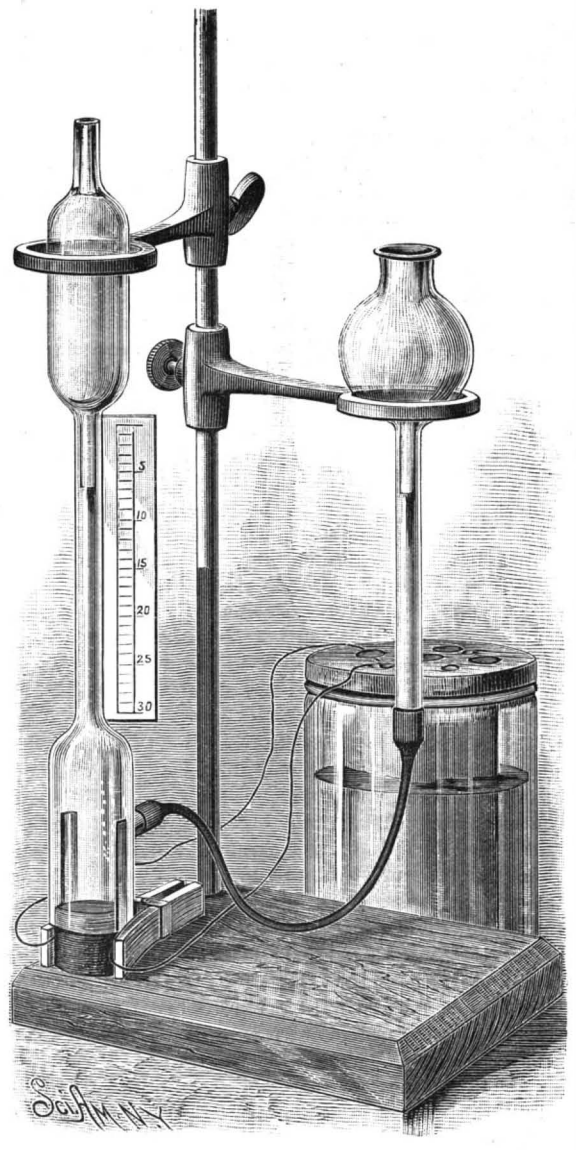
The apparatus may be supported in some kind of an improvised stand. As shown, it is arranged with a ring stand, an extra ring being borrowed to hold the funnel tube.

Some water is mixed with one-twentieth its volume of sulphuric acid and allowed to become perfectly cool. This fluid is poured into the funnel tube. It flows down through this into the decomposition tube. Air bubbles are almost certain to be carried with it. These are disposed of very easily by raising and lowering either tube several times until they all escape. In this way the acidulated water is added until it stands at about the middle of the stem of the funnel, and near the top of the scale attached to the decomposition tube. The ring carrying the funnel may be moved up and down, and water added very slowly until this condition is secured. Upon the stem of the funnel tube near its center a mark should be made. This may be done with a piece of thread tied around it, or with common ink. When filled, the water must stand exactly at the level of such mark.

The apparatus is allowed to stand for a few minutes, the funnel tube is adjusted if necessary, and the reading of the scale is taken and noted. The funnel is lowered until the level of fluid in the decomposition tube sinks just to the shoulder, but is well above the plates. Then a current of electricity is caused to pass through the water. The wires may be connected to the plates, as shown, by a spring clothespin.

At once bubbles rise in clouds from the plates. The gas as evolved may or may not be collected by a tube connected to the upper end of the decomposition tube. After ten or fifteen minutes' working, enough water will have been decomposed for its disappearance to be discernible. The battery is disconnected. The funnel tube is raised and lowered a few times to free the liquid of bubbles. It is brought to such a level that the fluid rises exactly to the mark on its stem, being allowed to stand before final adjustment, and a second reading is taken. This should be lower than the first, and the difference should give the amount of water decomposed. But as the gases are somewhat soluble in water, and as some gas may adhere to the platinum, the first reading will generally be higher, indicating an increase of volume. This reading, then, is taken as the basis. The funnel is again lowered, the current, for ten or fifteen minutes more, is passed through the solution, and the operations already described are repeated. This time the reading will be lower, indicating a disappearance of water.

Some knack is required to manipulate the apparatus. It should always be allowed to stand a few minutes before the final adjustment of the level of the funnel tube, to collect any drainage from the funnel. The experimenter must remember that he is making an exceedingly delicate measurement, and must exert patience and care. By raising and lowering either the funnel or the decomposition tube, or both in succession, every bubble can be disposed of without trouble.



APPARATUS FOR THE ELECTROLYSIS OF WATER.

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Commodore Matthew Calbraith Perry, the Inventor of the Ram in Naval Warfare.*

The changes in naval construction required by necessities of war have been many. The history of ship building is literally one of ups and downs. Three great revolutions of the oar, the sail, and the boiler have compelled the changes. The ancient sea boats grew into high decked triremes with many banks of oars, and these again to the low galleys of the Vikings and Berbers. The sides of these, in turn, were elevated until cumbersome vessels with low prow, many-storied and tower-like stern, and enormous top hampers sailed the seas. Again, the ship of the Tudor era was only, by slow processes, cut down to the trim hulls of Nelson's line-of battle ships.

In the clean lines of the American frigate, the naval men of our century saw, as they believed, the acme of perfection. They considered that no revolution in the science of war could seriously affect their shape. Down to 1862, this was the unshakable creed of the average sailor. Naval orthodoxy is as tough in its conservatism as is that of ecclesiastical or legal strain.

Yet both Redfield and Perry, as early as 1835, clearly foresaw that the old models were doomed, the many-banked ships must be razed, and the target surface be reduced. Steam and shells had wrought a revolution that was to bring the upper deck not far from the water, and ultimately rob the war ship of sails and prow. The next problem, between resistance and penetration, was to make the top and bottom of ships much alike, and to put the greater portion of a war vessel under water. It is scarcely probable, however, that either of them believed that the reduction of steam battery should proceed so near the vanishing point, as in the Monitor, to be described as "a cheese box on a raft" or "a tomato can on a shingle."

The first idea concerning "steam batteries," as they were called, was that they were not to have an individuality of their own as battle ships, but were to be subordinate to the stately old sailing frigates. They were expected to be tenders to tow the heavy battering ships into action, or to act as dispatch boats and light cruisers. They were conceived to be the cavalry of the navy—ships mounted, as it were. Redfield and Perry, on the other hand, laid claim for them to the higher characteristics of cavalry and artillery united in a single arm of the service.

The first English steamers were exceedingly cumbrous and unnecessarily heavy. It was with their ships as with their wagons or ax handles—the British, ignorant of the virtues of American hickory, knew not how to combine lightness with strength. Redfield proposed to apply the Yankee jackknife and whittle away all superfluous timber. Denying that the British type was the fastest or the best, he pleaded earnestly that our naval men should discard transatlantic models, and create an American type. Regretting that our government and naval men held aloof from the use of steam as a motor in war, he yet demonstrated that even a clumsy steamer like the Nemesis had proved herself equal to two line-of-battle ships. He prophesied the speedy disappearance from the seas of the old double and treble banked vessels then so proudly floating their pennants. Redfield, writing to Perry as a man of liberal ideas, said: "Opinions will be received with that spirit of candor and kindness which has so uniformly been manifested in your personal intercourse with your fellow-citizens." The confidence of this eminent man of science and practical skill in the naval officer was fully justified.

One thing which occupied Perry's thoughts for a number of years was the question of defending our Atlantic harbors from sudden attacks of a foreign enemy. Steam had altered the old time relations of belligerents. He saw the modern system of carrying on war was to make it sudden, sharp, and decisive, and then compel the beaten party to pay the expenses. A few hostile steamers from England could devastate our ports almost before we knew of a declaration of war. While England was always in readiness to do this, there was not one American sea-going war steamer with heavy ordnance ready to meet her swift and heavily armed cruisers, while river boats would be useless before the heavy shell of the enemy. He did not share the ideas of security possessed by the average fresh water congressman. The spirit of 1812 was not dead in him, but he knew that the brilliant naval duels of Hull and Decatur's time decided rather the spirit of our sailors than the naval ability of the United States.

He proposed a method for extemporizing steam batteries by mounting heavy guns on hulks of dismantled merchant vessels. These were to be moved by a steamer in the center of the gang, holding by chains, and able to make ten knots an hour. If one hulk were disabled, it could be easily separated from the others. Such a battery could be made ready in ten days and fought without sailors. The engines could be covered with bales of cotton or hay made fire proof with soapstone paint.

With the aid of his friend W. C. Redfield, he collected statistics of all the privately owned steamers in the United States, with their cost, dimensions and consumption of fuel, showing their possible power of conversion for war purposes. Encouraged by Perry, Mr. Redfield treated the whole question of naval offense and defense in a series of letters on "The Means of National Defense." These were printed in the New York *Journal of Commerce* during the summer of 1841, and afterward reprinted in the *Journal of the Franklin Institute*, in Philadelphia. His note books, with illustrations, diagrams, and pen sketches, show that his coming ideal war ships were like the Lackawanna of our civil war days, which, while but five feet narrower, is sixty-two feet longer than Old Ironsides, the Constitution of 1812. His favorite type was a long, narrow, and comparatively low vessel like the Kearsarge, which is twenty-two feet less in breadth than an old "seventy-four." Like Perry, he looked forward to the day when one eleven-inch shell gun would be able to discharge the metal once hurled by a twenty-gun broadside of the old President.

An accident which happened to the Fulton, one of the early war steamers of the U. S. Navy, revealed to Commodore Perry's alert mind a valuable principle, destined to work a revolution in the tactics of naval battles. Like the mountaineer of Potosi, who, when his bush failed as a support, found something better in the silver beneath, so Perry discovered at the roots of a chance accident a new element of power in war.

The Fulton was rather a massive floating battery than a sea steamer. Once started, her speed for those days was respectable, but to turn her was no easy matter. To stop her quickly was an impossibility.

On August 28, 1838, the Fulton, while making her way to Sandy Hook amid the dense crowd of sloops, schooners, ships, and ferry boats of the East River, came into partial collision with the Montevideo. The brig lay at anchor, and Lieutenant Lynch, in charge of the Fulton, wished to pass her stern, and ahead of her starboard quarter. When nearly up with the brig, the flood tide running strongly caused her to sheer suddenly to the full length of her cable, and thus brought her directly in line of the contemplated route. Lynch, to save life, was obliged to destroy property.

The steamer's cutter and gig were stove in and her bulwarks, in paint and nails, somewhat injured. With the brig, the case was different. Though only a glancing stroke, the smitten vessel was all but sunk.

Captain Perry was not on board the Fulton, having remained on shore, owing to indisposition. On hearing the story of Lieutenant Lynch, there was at once revealed to him the addition that steam had made to the number and variety of implements of destruction. The old trireme's beak was to reappear on the modern steam war vessel and create a double revolution in naval warfare. The boiler, paddle, and screw had more than replaced the war galley's banks of oars, by furnishing a motive power that thereafter should not only sink the enemy by ramming, but should change the naval order of battle. The broadside to broadside lines of evolution must give way to fighting "prow on." In a word, he saw the ram.

Perry required written reports of the affair from his lieutenants, and wrote a letter to the Secretary of the Navy suggesting the possibilities of the rostral prow.

To think of the new weapon was to wish to demonstrate its power. He proposed to try the Fulton again purposely, upon a hulk, to satisfy himself as to the sinking power of the steamer. He arranged to do this by special staying of the boiler pipes and chimneys, so that no damage from the shock would result. He was also prepared, by exact mathematical computation of mass, velocity, and friction, with careful observations of wind and tide, to express the results with scientific accuracy.

The report was duly received at Washington, and, instead of being acted upon, was pigeonholed. Perry was unable, at private expense, to follow up the idea, but thought much of it at the time, and the subject, though not officially noticed, remained in his mind.

After the Mexican war, having leisure, he wrote the following letter:

Washington, D. C., November 11, 1850.

Sir: Since the introduction of steamers of war into the navies of the world, I have frequently thought that a most effectual mode of attack might be brought into operation by using a steamer as a striking body, and precipitating her with all her power of motion and weight upon some weak point of a vessel of the enemy moved only by sails, and seizing upon a moment of calm, or when the sail vessel is motionless or moving slowly through the water.

I had always determined to try this experiment, should opportunity afford, and actually made preparations for securing the boilers and steam pipes of the Fulton at New York, when I thought it probable I might be sent in her to our eastern border ports at the time of the expected rupture with Great Britain upon the northeastern boundary question.

Experience has shown that a vessel moving rapidly through the water, and striking with her stem another motionless, or passing in a transverse direction, invariably destroys or seriously injures the vessel stricken, without material damage to the assailant. Imagine, for example, the steamer Mississippi under full steam and moving at the moderate rate of 12 statute miles per hour, her weight considered as a projectile being estimated at 2,500 tons, the minimum calculation, and multiplying this weight by her velocity, say 17½ feet per second, the power and weight of momentum would be a little short of 44,000 tons, and the effect of collision upon the vessel attacked, whatever may be her size, inevitably overwhelming.

It may be urged that the momentum estimated by the above figures may not be as effective as the rule indicates, yet it cannot be maintained that there would not be sufficient force for all the purposes desired.

I have looked well into the practicability of this mode of attack, and am fully satisfied that if managed with decision and coolness, it will unquestionably succeed, and without immediate injury to the attacking vessel. Much would of course depend on the determination and skill of the commander, and the self-possession of the engineers at the starting bars, in reversing the motion of the engines at the moment of collision; but coolness under dangers of accident from the engines or boilers is considered, by well trained engineers, a point of honor, and I feel well assured there would be no want of conduct or bearing in either those or the other officers of the ship.

The preparations for guarding the attacking steamer against material damage would be to secure the boilers more firmly in their beds, to prepare the steam pipes and connections so as to prevent the separation of their joints, to render firm the smokestack by additional guys and braces, to strip off the lower masts and to remove the bowsprit. All these arrangements could be made in little time and without much inconvenience.

It would be desirable that the bowsprit should be so fitted as to be easily reefed or removed, but in times of emergency this spar should not for a moment be considered as interposing an obstacle to the contemplated collision.

It will be said, and I am free to admit, that much risk would be encountered by the steamer from the guns of the vessel assailed, say of a line-of-battle ship or frigate; but considering the short time she would be under fire, her facilities for advance and retreat, of choice of position, and of the effect of her own heavy guns upon the least defensible point of the enemy's ship, on which she would of course advance, the disparity of armaments should not be taken into view.

I claim no credit for the originality of this suggestion, well knowing that the ancients in their sea fights dashed their sea galleys with great force one upon the other, nor am I ignorant of the plan of a steam prow suggested some years ago by Commodore Barron.* My proposition is simply the renewal of an ancient practice by the application of the power unknown in early times, and, as many believe, in the beginning of its usefulness. With great respect, I have the honor to be, Your most obedient servant,

M. C. PERRY.

The HON. WM. A. GRAHAM,
Secretary of the Navy, Washington, D. C.

Twenty years later, in the river of her own name, the war steamer Mississippi became a formidable ram, though before this time, in 1859, the French ironclad La Gloire had been launched. It had been said of the British Admiral Sir George Sartorius that "he was one of the first to form, in 1855, the revolution in naval warfare, by the renewal of the ancient mode of striking an adversary with the prow." It will be seen that Perry anticipated the Europeans and taught the Americans.

Other points in this letter of Perry's are of interest at this time. First, last, and always, Perry honored the engineer and believed in his equal possession, with the line officers, of all the soldierly virtues, notwithstanding that the man at the lever, out of sight of the enemy, must needs lack the thrilling excitement of the officers on deck. He felt that courage in the engine room had even a finer moral strain than the more physically exciting passions of the deck.

* Extract from "Matthew Calbraith Perry, a Typical American Officer," by William Elliot Griffis.

* Commodore James Barron's model of his "prow ship" was exhibited in the rotunda of the capitol in Washington in 1836. As described by him in the Patent Office reports, it was a mere mass of logs, white pine, poplar, or gum tree wood. Perry meant to use a real ship, always available for ramming.

A New Lake Steamship.

The new steel steamship Owego, of the Union Line, made a successful trip from Buffalo, December 7. Her length is 352 feet, beam 41 feet, hold 25½ feet. She has triple expansion engines, 28 × 48½ and 72 × 48 inches. Her wheel is 15 feet in diameter, with pitch of 22 feet. She has six steel boilers placed athwartship in the lower hold, three on either side, each 11½ × 11 feet. She was let out for a short time, and made 76 turns on 158 pounds pressure, or about 14 miles per hour. When in good trim and working order, she is to make 16 miles. Her carrying capacity is about 2,800 tons of freight, besides fuel, on 15½ feet. Her total cost was nearly $300,000. She is the largest craft in dimensions afloat on the lakes.

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GROUP OF GAS WELLS AT FORT SCOTT, KANSAS.

The town of Fort Scott, Kansas, appears to be in the enjoyment of special blessings, natural and artificial. The government sugar works are located here, and during the late sorghum cane harvest 16,500 pounds of merchantable sugar were daily manufactured, and the success of the sorghum sugar industry established.

One of the great natural resources of the place are the gas wells. We are indebted to the Fort Scott *Tribune* for our sketch and for the following particulars: There are now some twelve wells, from which uncounted millions of cubic feet are daily flowing. At night they glow like gigantic torches, with flames twenty feet or more in height, which illuminate the surrounding country. Pipes have been laid through the town, supplying light and fuel to everybody at a cost of almost nothing. Various manufacturing industries are now beginning to locate at Fort Scott, and others are coming in. The future prosperity of the place seems to be well settled.

Electrical Notes.

Electro-Metallurgy by Dry Way.—Mr. R. K. Boyte has devised a process for investing objects with a layer of metal by dry way, through the electric spark.

The object to be galvanized is covered with a sheet of the metal that is to furnish the deposit, and an intermittent discharge is sent through the junction.

Reduction of Light in Incandescent Lamps.—It sometimes happens, especially in libraries, that the light afforded by incandescent lamps is a little too intense, and that it becomes necessary to reduce it. For this purpose, opal glass has been proposed as a material for the globes. But experiment has shown that this absorbs from 40 to 60 per cent of the light that traverses it, and that ground glass absorbs from 25 to 35 per cent. This is too great a loss. A simple method, recently proposed, consists in dipping the globe in either common or photographic collodion and allowing it to dry. If the deposit obtained is not thick enough, the operation may be repeated. The diminution of light effected by this means is scarcely 10 per cent.

In addition to cheapness, the method has the advantage that the collodion can be easily removed from the glass at any time.

Soldering Electrical Conductors.—To prevent the loss of time that accompanies the cleaning of the rusty or dirty extremities of telegraph wires previous to soldering them together, Mr. Prisiajniky proposes the following process:

The necessary quantity of solder is put into an iron pot, which is placed over a brazier. When the solder is melted, fragments of sal-ammoniac are thrown on it, in the proportion of one ounce to the pound of lead. Vapors of chlorine then appear, and the liquefied sal-ammoniac covers the surface of the lead in a blackish stratum. The soldering is effected by simply dipping the uncleaned wire into the black liquid and afterward allowing it to enter the lead. If the solder does not adhere on the first trial, the operation is to be repeated.

New Carbons for Arc Lamps.—Mr. Gime has devised a new process of preparing carbons for arc lamps, which it is said give good results. These carbons are made as follows: Equal parts of close-burning coal and very pure coke are triturated together, and to them is added a sufficient quantity of water saturated with boric acid to make a plastic paste, which latter is passed through moulds under a pressure of from 75 to 100 atmospheres. The rods obtained are cut to the proper length, put into a furnace, and raised to a bright red heat. A single baking produces very dense and hard carbons.

The Convection of Electricity by Steam.—While Mr. Edison has been pursuing his researches on the pyromagnetic production of electricity, Prof. Van Lang and Dr. Lecher have been studying the convection of electricity by steam, and the results of their experiments have been recently read by one of these physicists before the Vienna Academy of Sciences.

As well known, the disengagement of steam is accompanied with a production of electricity. The well known Armstrong laboratory machine affords an excellent practical demonstration of this. Dr. Lecher shows through thermometric experiments that, under identical circumstances, an electrified liquid vaporizes much more rapidly than one that is not electrified. It seems that this phenomenon is not due to the electrification of the steam, but that the increase in vaporization is due almost exclusively to the quite intense electric wind which is produced on the surface, and which renders it difficult to measure the quantity of heat necessary for the vaporization of an electrified liquid.

By a simple experiment, Dr. Lecher has demonstrated that when the surface of a liquid is strongly electrified a cloud of steam or of water in a vesicular state is produced. This cloud is electrified, remains in suspension in space, and produces effects of characteristic influence. Although these experiments have not as yet furnished conclusive data, they afford so many stepping stones on the way to the direct conversion of heat into electricity, and *vice versa*.

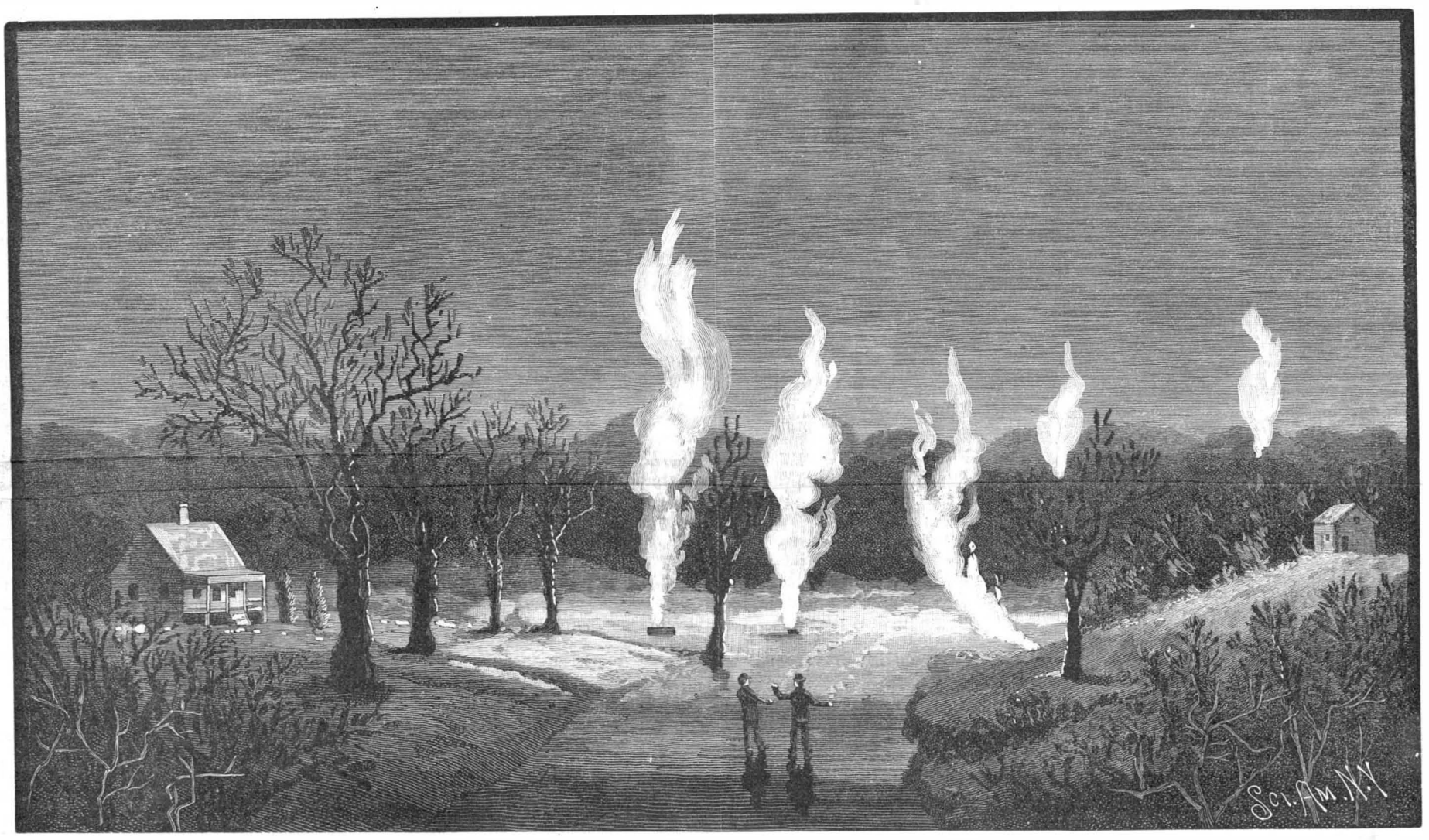
Action of Magnets on Liquids.

Professor S. T. Morehead, of the Washington and Lee University, at Lexington, Va., writes as follows to the *American Journal of Science:* Some weeks ago one of my students, Mr. J. C. Child, and myself were working with a diamagnetic instrument, simply repeating well known experiments. Plucker's method of observing the diamagnetism of liquids having failed in our hands to give satisfactory results, we hit upon a method which was new to us, and which was very satisfactory. Into a glass tube of about four or five mm. internal diameter, a small quantity of liquid was introduced, forming a short cylinder. This tube was placed horizontally at right angles to the line joining the poles of the magnet, with the liquid nearly between the poles. When the current was turned on, the liquid was very evidently repelled. Water was repelled through a distance of about a centimeter; wood spirit through a greater distance. By moving the tube in the direction of its length, the wood spirit could be pushed any distance through the tube. The amount of motion is, of course, a function of the resistances due to adhesion and friction, as well as of the repulsive force. The attraction of liquids is easily shown by the same methods. A single modification of the above plan of proceeding is to incline the tube slightly, so as to make the liquid flow toward the poles. If the required velocity be not too great, the magnet acts as a brake to stop the motion. It is well to bend the tube up a little at each end to prevent the liquids from flowing out. This method is well adapted for projection so as to be seen by large audiences.

An African Poison.

In a report just published by the Foreign Office, on the trade of the Nyassa territories, Mr. Hawes, the newly appointed consul, describes the strophanthus, a climbing plant from which the natives extract a strong poison, and which is beginning to find its way into the London market. It is called by the natives *kombe*, and is found at a low level, and not apparently on high land. The supplies hitherto obtained have been drawn from the right bank of the Shire River below the Murchison Rapids.

There is apparently more than one species, or at least variety, the distinguishing feature being a much smaller pod and fewer seeds. At present, information relative to the varieties is scant. It is a strong climbing plant, and is always found in the vicinity of high trees, on which it supports itself. The stem varies in diameter, but has an average of a few inches. It lies on the ground in folds, the branches supporting themselves on the nearest trees. The young branches are in appearance not unlike the elder. The fruit grows in pairs, and has a peculiar appearance, very like a pair of immense horns hanging to a slender twig. It begins to ripen in July, and lasts till the end of September. The native method of preparing the poison is very simple. They first clean the seeds of their hairy appendages, and then pound them up in a mortar until they have reduced them to a pulp. A little water is then added. This is done by using the bark of a tree containing a gummy substance, which helps to keep the poison on the arrow, in the event of its striking against a bone. The poison thus prepared is spread upon the arrow, and allowed to dry; game wounded by arrows poisoned with strophanthus dies quickly. The flesh is eaten without evil effect. The only precaution taken is to squeeze the juice of the baobab bark on the wound made by the arrow, and this counteracts the evil effects of the poison. Buffalo and all smaller game are killed by this poison. The drug is rapidly coming into medical use, especially in cardiac affections, Bright's disease, renal colic, etc.



GROUP OF GAS WELLS AT FORT SCOTT, KANSAS.

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ENGINEERING INVENTIONS.

A safety water gauge valve has been patented by Mr. Peter Barclay, of East Boston, Mass. This invention provides a valve of which one section will be automatically seated in case the glass should be broken, and in which the other section may be turned down upon its seat, thus releasing the section which is closed.

A car coupling has been patented by Mr. Francis M. Hewett, of Beirne, Ark. The drawhead has hinged spring-actuating jaws which engage with one end of a double-headed coupling bar, the other end of the bar being held in a similar manner within the drawhead of the adjacent car, the device being operable from either side of the car to release the coupling bar.

A car coupling has been patented by Mr. Edward McC. Reynolds, of St. Louis, Mo. The coupling hook or drawbar is adapted to be pivotally supported between its ends, its forward end having means for coupling with a meeting drawbar, and its rear end having a hook or shoulder to engage against the rear side of a suitable shoulder or bearing on the drawhead, with other novel features.

AGRICULTURAL INVENTION.

A gopher cultivator has been patented by Mr. Thor. O. Thorson, of Elliott, Ill. It is so constructed that the shovels may be given any desired inclination that the nature of the ground and character of the work demands for successful cultivation, the invention covering various novel features of construction and the combination of parts.

MISCELLANEOUS INVENTIONS.

A snow shoe attachment has been patented by Mr. Benjamin C. Woodbury, of Patten, Me. It is a flexible hinged foot, or toe and heel attachment, designed to give freedom to the working of the foot, without restricting the turning of the snow shoe by the foot.

A passenger elevator has been patented by Mr. Seth K. Humphrey, of Faribault, Minn. It has an endless chain passing over sprocket wheels, of which one is rotated, platforms fastened on the chain, and guides for holding the platforms, making an elevator especially adapted for carrying employes in factories, mills, etc.

A vegetable slicer has been patented by Mr. David F. McDonald, of Lake Butler, Fla. It is so made that the gauge plate serves also as a rest plate or support on which the vegetables rest, and as the carriage reciprocates, the vegetables will be cut into slices and drop on a plate, whence they may drop into any suitable receptacle.

A curtain fixture has been patented by Mr. Robert P. Trimble, of Oregon, Mo. This invention covers an improvement on a former patented invention of a curtain shade and lambrequin fixture of the same inventor, and consists of a peculiar construction of the castings, with reference to the cheaper production of the fixture.

A folding ladder has been patented by Mr. William S. Ethridge, of Paluxy, Texas. It is so made that it can be arranged for use to form a protected way through which parties may pass, being especially applicable for use in mines, and for a fire escape, while it may be folded in small space for convenience in storing and transportation.

An expansible lunch box has been patented by Mr. John S. McGuire, of Bayonne, N. J. Combined with telescopically sliding box like sections, with a cover on the upper section, are adjustable straps and buckles for connecting the cover with the lower section, making a box which can be enlarged as desired and contracted when not in use.

A counting attachment for thrashers has been patented by Messrs. Jefferson C. Rand and Edwin Thompson, of Maynard, Iowa. This invention covers a novel construction and combination of parts in a practical adding or counting device to be used principally for tallying the measures of grain in connection with thrashing machines.

A faucet has been patented by Mr. William B. Rodman, of Norfolk, Va. It is particularly adapted for use with stationary basins, and is so made that either or both hot and cold water may be made to flow from one spout and be controlled by one handle, and the flow be increased or diminished, or the proportions changed, as desired.

A reel for harvesters has been patented by Messrs. J. Calder Cunningham and George A. Cunningham, of Washington, Kansas. Combined with the reel and its driving mechanism is an adjusting and holding mechanism, the invention being an improvement on a former patented invention of the same inventors.

A hitching device has been patented by Mr. Willard G. Thorpe, of St. Paul, Minn. The invention embraces combining with the vehicle a weight having a connection for securing it to the horse, the connection being disposed over a guide on the vehicle, with a detent whereby the force of the weight may be held clear of or be freed to secure the horse, as desired.

A folding table for paper hangers has been patented by Mr. Edward M. Addaman, of Jersey City, N. J. It has a folding top and folding end supports, and is so made that the top and supports can be readily unfolded and the table set up for use, or quickly folded into compact form for removal, the table when set up being firmly braced and supported.

A dumb waiter has been patented by Mr. Garrett M. Emerick, of Brooklyn, N. Y. This invention covers a novel construction and arrangement of parts in an elevator which is perfectly protected against the falling of the car, and in which the descent of the car can be easily controlled, while it may be stopped and held in any desired position, even when heavily loaded.

A water elevator has been patented by Mr. Monroe Stevens, of Shellman, Ga. It is designed to elevate water from a well in a bucket in such manner that when the bucket has reached its highest point it will be automatically engaged by a hinged chute, and the water emptied through the bottom of the bucket into the chute, the apparatus being operable by a windmill.

A photographic accessory has been patented by Mr. John W. Tinsman, of Kirksville, Mo. It comprises a novel form of clamping frame, with other details, for exposing on the floor or about the base of a subject grasses, weeds, or grain, or other vegetable products, including cut flowers, to give a rural or ornamental appearance to the picture when photographed.

A device for holding cans has been patented by Mr. George W. Hill, of Stark's Point, Washington Ter. It is a device for holding cans, casks, barrels, and similar receptacles in such way as to facilitate emptying them, and consists of a bracket or frame adapted to be attached to a wall, with a spider-like bottom to be supported in such bracket, with other novel features.

A continuous dough press has been patented by Mr. Justin J. Langles, of New Orleans, La. Plain rollers are journaled in a frame to revolve toward each other, with a trough arranged between them, its sides in close proximity to the rollers, and with an aperture in its bottom and dies in the bottom of the trough, for pressing dough in continuous strips or sheets.

A fish trap has been patented by Mr. Abner H. McDowell, of Progress, Va. It differs from the ordinary trap principally in having the guide hood at the rear end of the trap and a box on the side, the improvement being simple and inexpensive, and such as can be attached to any trap already in the water, whereby the fish may be caught at low or high tide, and safely retained without danger of being stolen.

A medical compound for dyspepsia, etc., has been patented by Mr. Albert Marx, of Baltimore, Md. It consists of water pepper, root ginger, garden melisse, peppermint leaves, pennyroyal, lobelia inflata, rosemary, cramp bark, golden seal, blood root, prickly ash bark, wahoo bark, capsicum, golden rod, horseradish, and other ingredients, in certain proportions and prepared after a described manner.

A temple plate for power looms has been patented by Mr. John J. Honan, of Fall River, Mass. It has a slotted bottom plate having at one end a lug, with a slot between the lug and the body of the plate for the passage of the selvedge of the woven fabric, with other novel features, the improved plate being one which can be attached to all kinds of temples, especially the well known Dutcher temple.

A leveling rod has been patented by Mr. Walter J. Ritchie, of Lima, Ohio. It is so constructed that the engineer or surveyor may read the elevations in feet and fractions of a foot through the telescope attached to a leveling instrument at a distance of a thousand feet or more, thus keeping his own record and dispensing with reports of such elevations from the rodmen.

An apparatus for distilling wood has been patented by Mr. Gasper Hunziker, of Cloverdale, Cal. It embraces a cage on wheels for running the wood on rails into an oven having a specially constructed bottom to aid in the passage of the heat and escape of the products of distillation, with various other novel features, being an improvement on a former patented invention of the same inventor.

A grain weighing apparatus has been patented by Mr. Le Roy C. Tryon, of Marseilles, Ill. It has a stationary hopper with a sliding bottom operated by a measuring receptacle pivoted on the weighing beam, and connected with the mechanism for returning the receptacle after dumping the measured grain, making a machine that will automatically weigh and measure grain with great accuracy.

A trousers stretcher has been patented by Messrs. Walter A. and Harrison S. Rollins, of Chicago, Ill. It has end clamps, side bars arranged in pairs, joint bars pivotally connected at their opposite ends with inner ends of the side bars, and means to secure the joint bars in different adjustments with reference to the side bars, making a convenient device for restoring distorted garments to their proper shape.

A permutation padlock has been patented by Messrs. Marshall B. Palmer and Clark S. Mudge, of Germantown, Neb. The main frame has recessed side faces to receive disks formed with slots which extend from the peripheral edges of the disks inward toward the center, with other novel features, making a strong and simple lock, very difficult to open unless one has the two combinations necessary.

An automatic egg boiler has been patented by Mr. George L. Dale, of New York City. It has inner and outer chambers so arranged that the eggs will be subjected to sufficient heat to produce a proper coagulation of the albumen, but not subjected to so great a heat as usual, whereby the albumen is made hard, instead of soft and creamy, as designed by the use of this invention.

A combined cart saddle and yoke has been patented by Mr. Thaddeus Ivey, of Ashpole, N. C. The invention consists in the peculiar construction and arrangement of a yoke suspending the tongue or shafts by a chain, and having a peculiar adjustable connection with the saddle sustained upon the backs of the two horses, the device being one which can be used in conjunction with the ordinary traces and singletrees.

An automatic grain weighing scale has been patented by Mr. Henry Cutter, of North Wilbraham, Mass. Combined with an oscillating lever are weighing beams loosely connected with the lever by S-shaped hooks, grain boxes supported on the beams, and a pivoted grain spout adapted to connect alternately with the grain boxes, and operated from the oscillating lever, with other novel features, the scale being simple and durable.

A zinc casting machine has been patented by Messrs. Joseph J. Smith, of Jamaica, N. Y., and Charles A. Janson, of New York City. It is specially adapted for making zinc beds used for separating the iron magnetic folds of dynamo electric machines from the iron bed plates, and provides for the core being held firmly in place in the flask, no pressure being required to force the fluid metal into the mould, and producing castings rapidly of very superior quality.

A grain weighing apparatus has been patented by Mr. George P. Jameson, of Abingdon, Ill. Combined with a spring weighing scale is a counterbalanced grain cylinder, lugs on the sides of the cylinder engaging hooks carried by adjustable lever arms, so that when the uppermost compartment of the cylinder is filled with a certain amount of grain the lugs are disengaged from the hooks, with other novel features, the machine being also adapted for weighing other substances.

A piano tuning pin has been patented by Mr. Fred E. H. Goodenow, of Springfield, Mo. It has a fixed collar, and there is a fixed bushing in which the pin turns, washers being held on the pin and against the top and bottom of the bushing, a clamping collar being held on the pin and turning with it, while there is a nutfor pressing the clamping collar against the lower washer, the pin being securely held in place and not materially influenced by changes of temperature.

A cotton gin has been patented by Mr. Benjamin Andrews, of New Orleans, La. The saws employed are much thinner than those in ordinary use, and they are clamped between spacing frames having a continuous periphery, the stock being fed into the top of the roll box, the seed, etc., dropping out of the bottom, the first grade of stock being delivered to the brush and passing out of the back of the machine, while the second grade separates by being thrown down between the saws and brush.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY NUMBER.

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How often do we drag on, day after day, with nought especially to complain. of, but general debility and perhaps some weakness of the lungs? We feel conscious of the latter because we take cold so easily, and any cough we may get seems to stick so closely to us, and we feel an occasional soreness in the chest. The former does not apply to any specific ailment, for we cannot localize our trouble so as to give it a definite name, yet we feel such a general good-for-nothingness, that we call it by the generic name of "general debility." If we are feminine, we feel that this term embraces our misery, and there are so many like ourself we are easily understood. But what would we not give to find relief? A patient living in Boston Highlands, Mass., in a letter of November 6, 1885, says:

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Lathes for cutting irregular forms a specialty. See ad. p. 349

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 and 421 East 8th Street, New York.

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Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 364.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. T.—For the horse power, multiply the area of the piston by the mean engine pressure, which is always something less than the boiler pressure, and may be computed by knowing the point of cut-off. This product multiply by the speed of the piston in feet per minute. Divide the last product by 33,000 for the horse power. Your engine probably indicates 23 to 25 horse power. Exact instructions cannot be given for setting the eccentrics of your traction engine without the exact measure of the lap and plan of lever connection. Place the crank on the center and the cams exactly opposite to each other with their central line leaning forward in the direction in which the crank is moving, sufficient to open the port at or near the time of passage of the crank over the center, is a general rule, from which a trial can be made. For casehardening, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 23.

(2) W. M.—The brazing of iron and steel is readily accomplished by first cleaning the surfaces that are to be brazed free from scale or rust and make them to fit closely, as the brass or copper used for brazing does not flow well into open spaces. Rub the surfaces to be united with borax and water, then tie the parts together with iron wire or in any other convenient manner. Sprinkle the edge of the point with pulverized borax and tie on a piece of ordinary yellow brass large enough to fill the joint. Sprinkle the brass with borax powder, and place the work in a forge fire with the brass on the upper side, and heat gently until the brass melts and draws through the joint. Copper may also be used in the same way, it being very suitable and strong for iron. Good tough brass is best for steel.

(3) J. P. B. writes: Some three weeks since, a large barn containing baled hay was burned in this place. The fire was first seen near the floor of the loft, and there were several layers of bales of hay above the fire. The day was warm, although a strong wind from the north. We are anxious to know the origin of the fire. Will baled hay become heated so as to become ignited and take fire? A. Baled hay that has not been well cured is liable to heat and ferment; and if packed closely in a barn, its spontaneous ignition would be possible. A box packed with damp sawdust has been known to ignite in the central portion of the sawdust. A short time since, we saw a smoking barrel rolled out of a store and broken open. It was filled with sawdust as a packing for telegraph insulators. The sawdust on the outer side next the barrel was wet, the interior was charred. The report was that the barrel had been received the day before as freight, and had been wet in a shower. Cotton in bales stowed as freight in ships has been known to take fire. A wet bale was probably the cause.

(4) M. R. W. asks for a weight motor that could be cheaply constructed, to develop say one horse power for about five hours at a time, and whether such motor would be practicable for continuous use. How heavy weights would be required? Also the power needed to drive the works of large tower clocks where weights are used? A. Efforts to utilize large weight motors generally cause loss of both time and money. To maintain a horse power for five hours will require the descent through 30 feet of space of a weight of 1,650 net tons, to which must be added a large percentage for the friction of the machinery. To wind up the weight requires a full horse power for 5 hours and enough more to overcome the friction. The friction alone of such contrivances is almost unavoidably very great. The power to drive an ordinary tower clock is comparatively small, always depending upon its size and perfection. A one man power for half an hour will run the clock a day or a week, according to its construction.

(5) O. S. P.—For casehardening large pieces of steel, a box of cast or wrought iron should be provided large enough to hold one or two of the pieces, with sufficient room all around to pack well with the casehardening materials, which may be leather scrap, hoof shavings, or horn shavings, slightly burned and pulverized, which may be mixed with an equal quantity of pulverized charcoal. Pack the pieces to be casehardened in the iron box so as not to touch each other or the box. Put an iron cover on the box and lute with clay. Heat gradually in a furnace to a full red, keep at an even temperature for from 2 to 4 hours, raise the heat to a cherry red during the last hour, then remove the cover and take out the pieces and plunge endwise vertically in water at shop temperature; 2 per cent of hydrochloric acid in the water improves its tempering qualities and gives the metal an even gray color.

(6) J. T. writes: This bank is heated by steam, and the air is oppressively dry. Is there any device on the market for introducing steam into rooms in a noiseless way? A. You may take steam from the radiators with a very minute air valve. This will have an odor. A better way is to have small tin boxes fastened against the pipes behind the radiator in such a way as to allow of removal for cleaning. Keep them full of clean water.

(7) M. N. B. asks (1) how to take down the rust of old cast iron and steel machines, which have not been in use for ten years. A. Scrape off all rust scales, boil in strong caustic soda and water to remove grease and oil. Then dip in a bath of hydrochloric acid 1 part, water 4 parts, for a few hours or until the rust is removed. Wash in hot water, then dip in strong hot lime water and dry. 2. A receipt for japanning small hooks. A. String the hooks on fine wire dipped in thin japan varnish, and hang in an oven heated to 260° to dry. If varnish is too thick, thin with turpentine.

(8) J. T. T. writes: We are having iron castings made in which we cast a ¾ inch wrought iron rod, and we find after the casting is cold that the rod is loose. How can this be prevented? A. Tin the rod or such parts as are required to adhere.

(9) Subscriber asks what chemical preparation becomes ignited on coming in contact with water. A. Metallic potassium. It is very dangerous, as it explodes when thrown upon water. Phosphide of calcium ignites when moistened.

(10) O. D. asks (1) if an induction coil would be injured by using too many cells to operate it. A. Yes; you must be very careful not to use too strong a current. 2. How can I get a copy of the Smithsonian report? A. Address your representative in Congress, or the Secretary of the Smithsonian Institution, Washington, D. C.

(11) A. J. asks: What acid is used in engraving on glass, causing the picture to appear as if ground? A. Hydrofluoric acid is used in glass etching, and the sand blast is often used to effect the result described.

(12) H. A. R. asks: 1. Can you tell, as as closely as possible, what lengths of No. 28 (B. & S. gauge) copper and German silver wire represent one ohm, according to the standard determined by the Paris congress, read of not long ago? A. Of No. 28 copper wire 67·542 feet are given as corresponding to 1 ohm resistance. This is only approximate in practice, as every particle of impurity affects the conductivity of wire. The resistance of German silver varies also with its composition. The relative resistances of German silver and copper are given as 21·17 (German silver) is to 1·616 (annealed copper). 2. Why is the E. M. F. of Daniell's cell sometimes given as 1·079, 1·105, and 1·122 volts? Is the first the actual working E. M. F. and the last two potential or chemical E. M. F.? A. The E. M. F. of a. Daniell cell varies with the solutions used. 3. Will a differential galvanometer do to measure the E. M. F. of a battery by Wheatstone's method? What is a convenient resistance for such a galvanometer? A. For Wheatstone's method any sensitive galvanometer will answer. A good galvanometer, giving resistances, etc., is very fully described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 628. 4. Will a gravity Daniell do for measuring, or has it too high resistance, and what form of the same cell has the lowest resistance with least polarization? A. A good Daniell standard battery is described in the SCIENTIFIC AMERICAN, vol. 56, No. 24, page 370. The gravity is not suitable for a standard. A large sized porous cup Daniell has the lowest resistance for a non-polarizing battery.

(13) C. H.—The position of foul air in a room depends entirely upon its kind. The foul air caused by the escape of gases (as coal gas) rises to the top of the room, and the carbonic acid gas from burning gas or a stove is only carried to the top of a room by the heated currents.

(14) O. E. V. asks how the world is weighed and its density and mass computed. A. The density, mass, or weight of the earth was found by the observed force of attraction of a known mass of lead or iron for another mass; or of a mountain by the deflection of a torsion thread or plumb line. In this manner the mean density of the earth has been found to be from 4·71 to 6·56 times the weight of water, 5·66 being accredited as the most reliable. The weight of a cubic foot of water being known, and the contents of the earth being computed in cubic feet, we have but to multiply the number of cubic feet by 5·66 times the weight of 1 cubic foot of water to obtain the weight of the earth in pounds, or units of gravity at its surface, which is the unit usually used. Another method of determining the mean density of the earth is founded on the change of the intensity of gravity in descending deep mines.

(15) A. R. D.—Professor C. V. Riley makes the following reply: The twig of *Euonymus* (*latifolia*?) sent is infested with a scale insect, *Chionaspis euonymi*, Comstock, described and figured Rep. Dept. Agr. 1880, page 313, plates v., Fig. 3, xvii., Fig. 2. It is common on Euonymus, and has also been taken from orange in Louisiana. Those remedies which have been successful against scale insects infesting orange trees will prove successful against this. The most successful wash is the kerosene emulsion, made by either of the following formulæ:

1. Kerosene ..... 2 parts.
   Milk ..... 1 part.

Sour milk (not buttermilk) is preferable, as the emulsion is more stable when thus made. Instead of milk, water can be used by adding a small amount of soap. The proportions remain about the same. The following formula is a very convenient one to use for small quantities:

2. Kerosene ..... 2 quarts.
   Water ..... 1 quart.
   Whale oil soap ..... ½ pound.

In either case the milk, or soap and water, should be heated to boiling, and with the latter the soap thoroughly dissolved, then the kerosene added while hot, and the mixture thoroughly agitated until it forms a homogeneous mass of cream-like consistency. It can be agitated by churning, shaking, or otherwise, but where a force pump is at hand, the most convenient method is to pump the liquid back in upon itself violently, forcing it through a small nozzle. This continued for five to fifteen minutes will produce a good emulsion, if proper care has been taken in preparing the mixture. The emulsion will remain stable for an indefinite period, and should be diluted only as wanted for use. The strength required varies for different insects, also some plants will bear it stronger than others. This wash can safely be used on orange 1 part to 10 of water. The treatment should not be repeated until first application has had time to be effectual, say ten days or two weeks. It is best not to apply during freezing weather. On a small scale application may be made with brush or cloth, but the most convenient and effective method is with force pump, using a fine spray nozzle like the cyclore or some other good nozzle. The treatment of such insects has been fully discussed from time to time in my official reports, and especially in Hubbard's report on Insects Affecting the Orange.

(16) P. G. asks: What kind of paint can I use to keep cold water iron tanks from sweating? A. Thoroughly dry and clean the tanks. Paint with 2 coats Prince's metallic paint in boiled linseed oil, first coat to be dry before painting second coat. No paint will entirely prevent sweating, but it does diminish it.

(17) A. M. D. asks if the use of sal soda to clean the scale and grease from a steam boiler would be detrimental to the boiler. A. Sal soda and caustic soda are both used for cleaning boilers. They are not injurious. See also for other boiler cleaners, "Davis on Boiler Incrustation," which we can furnish for $2.00.

(18) R. W. J. asks if one 2 inch pipe will carry more water than four 1 inch pipes, all things being equal. A. Area of 2 inch pipe equals 3·1416 inches; area of four 1 inch pipes equals 3·1416; the internal surface of 2 inch pipe=6·2832; the internal surface of four 1 inch pipe=12·664; the coefficient of discharge for one 2 inch pipe is 26·66; the coefficient of discharge for four 1 inch pipes is 18·84. These figures give the proportionate discharge of one 2 inch pipe or four 1 inch pipes for any length.

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POPE'S ESSAY ON MAN, WITH RESPONDING ESSAY, MAN SEEN IN THE DEEPENING DAWN. By Caleb S. Weeks. Fowler & Wells Co., Publishers. Paper. 25 cents.

On one page is given Pope's grand essay, and on the opposite page Week's responding essay—the latter being written in like form, like meter, and with the same number of lines as the original. It is designed to explain and amplify the prototype in the light of the learning and philosophy of the present century.

STANDARDS OF LENGTH AND THEIR PRACTICAL APPLICATION. Edited by George M. Bond. The Pratt & Whitney Company, Hartford, Conn.

This book affords a *resume* of methods employed, by the enterprising company publishing the work, for the production of standard gauges, to insure uniformity and interchangeability in every department of manufactures. It includes reports by Professor William A. Rogers, the Committee on Standards and Gauges of the American Society of Mechanical Engineers, and other valuable information, all illustrative of the great care and thoroughness with which the company conduct their manufacture of standard gauges.

The Pope Manufacturing Company has issued a calendar for 1888, in pad form, with blank for memoranda on each leaf. Upon each slip also is printed something pertaining to cycling, a collection of quotations illustrating the popularity and universality of cycling.

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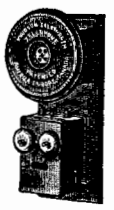

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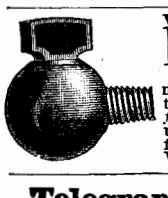

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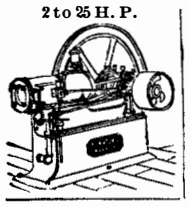

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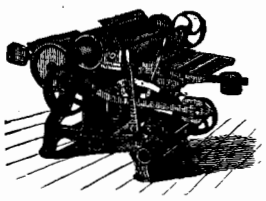

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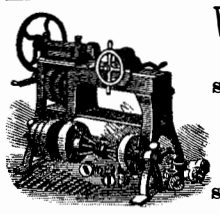

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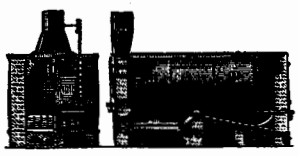

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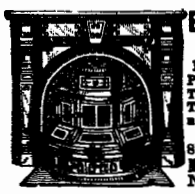

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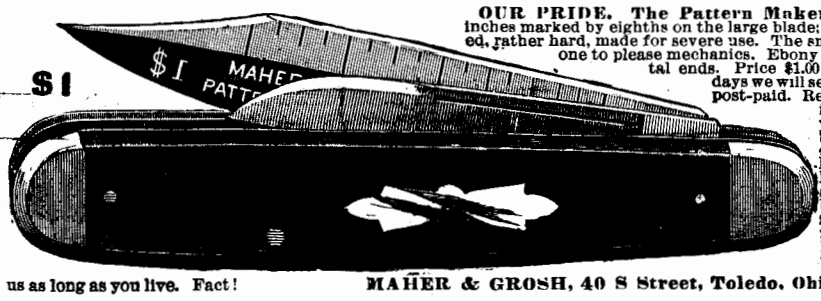

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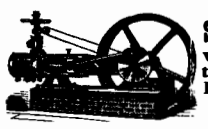

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Proposals for Tools for the Navy Yard, Brooklyn, New York.—NAVY DEPARTMENT, WASHINGTON, D. C., *November* 25, 1887.—Sealed proposals will be received at this Department until 12 o'clock noon, on Monday, the sixteenth day of January, 1888 at which time and place they will be opened in the presence of attending bidders, for furnishing tools and materials required by the Bureau of Construction and Repair, and for the delivery of the same at the Navy Yard, Brooklyn, New York. Printed schedules particularly describing the tools, blank forms on which proposals must be made, and all other information essential to bidders can be obtained by regular dealers in, or manufacturers of, the articles required, on application to the Commandant of said Navy Yard. Proposals must be made in duplicate, and enclosed in sealed envelopes marked "Proposals for Tools for the Navy Yard, Brooklyn, New York," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. All bids must be accompanied by either plans or descriptive cuts of the principal tools which the dealer offers to furnish. The Secretary of the Navy reserves the right to reject any or all bids, in whole or in part, as, in his judgment, the interests of the Government may require.
D. B. HARMONY, *Acting Secretary of the Navy.*

Proposals for Machine Tools for the Ordnance Gun-Shops.—NAVY DEPARTMENT, WASHINGTON, D. C., *November* 2, 1887.—Sealed proposals will be received at this Department, until 12 o'clock noon, on Thursday, the 1st day of March, 1888, at which time and place they will be opened in the presence of bidders, for furnishing the necessary material and labor and constructing sixteen (16) 16-inch gun lathes, and for the delivery and erection of the same in the Navy Yard, Washington, D. C., in accordance with plans and specifications, copies of which, together with all other information essential to bidders, may be obtained at the Bureau of Ordnance in this Department. Proposals must be made in duplicate, in accordance with forms which will be furnished on application to the Bureau of Ordnance, and enclosed in envelopes marked "Proposals for 16-inch Gun Lathes," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. The Secretary of the Navy reserves the right to reject any or all bids, as, in his judgment, the interests of the Government may require.
D. B. HARMONY, *Acting Secretary of the Navy.*

NAVY DEPARTMENT, WASHINGTON, *December* 30, 1887.—The time fixed by this Department's advertisement, dated November 2, 1887, for receiving proposals for 6-inch gun lathes, and slotter, is hereby extended to 12 o'clock noon, February 2, 1888, at which hour the opening of the bids will take place. WILLIAM C. WHITNEY, *Secretary of the Navy.*

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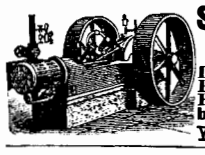

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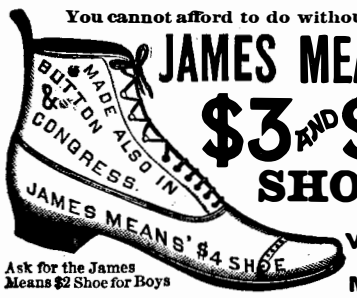

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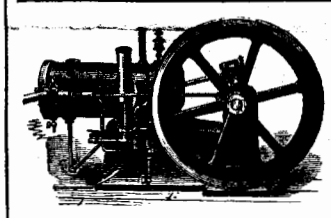

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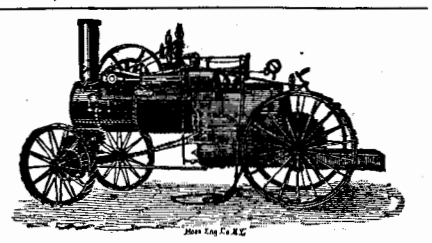

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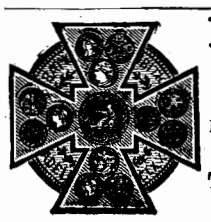

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